

COMMONWEALTH OF PENNSYLVANIA.

DEPARTMENT OF AGRICULTURE.

BULLETIN No. 81.

Concentrated Commercial Feeding-Stuffs in
Pennsylvania.

BY

WM. FREAR, PH. D.

AN INVESTIGATION BY THE DEPARTMENT OF AGRICULTURE OF
PENNSYLVANIA IN CO-OPERATION WITH THE PENNSYL-
VANIA STATE COLLEGE AGRICULTURAL
EXPERIMENT STATION.



PUBLISHED BY DIRECTION OF THE SECRETARY.

1901.

WM. STANLEY RAY,
STATE PRINTER OF PENNSYLVANIA.
1901.

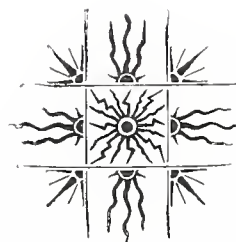


TABLE OF CONTENTS.

	Page.
Preface,	5
The Use of Commercial Foods,	7
Cotton-Seed Products,	13
Linseed Products,	16
Wheat Products,	19
Rye Products,	34
Barley Products,	35
Oat Products,	38
Corn Products,	42
Buckwheat Products,	57
Mixed Foods,	58
Special Poultry Foods,	66
Condimental Foods,	67
Relative Cost of Feeding Stuffs as Sources of Protein,.....	78
Character of Cattle Foods in Neighboring States,	80
Weights of Feeding Stuffs,	83
Composition of Feeding Stuffs,.....	84
Appendix,	97
Cattle Food Laws of the Several States,	99
Index of Manufacturers and Retail Dealers,	121
General Index,	127



PREFACE.

Harrisburg, Pa., September 1, 1901.

The following Bulletin, No. 81, giving the results of an investigation into the character of "Concentrated Commercial Feeding-Stuffs" sold in Pennsylvania, was undertaken in the summer of 1900 under an arrangement between this Department and the State Agricultural Experiment Station.

At the time at which the investigation was begun, Pennsylvania had no cattle food control law, but during the last winter the Legislature passed an act providing for the inspection of cattle foods in this State.

The necessity for such legislation is apparent, from the data given in this Bulletin, gathered from samples of foods found upon the markets. The examination shows that some brands are almost worthless and others are badly adulterated. The law provides for an examination of all cattle foods sold in Pennsylvania, and requires that each package shall be marked with "the number of net pounds of feeding stuff contained therein; the name, brand or trade mark under which the article is sold; the name and address of the manufacturer or importer, and a statement of the percentage it contains of crude fat and of crude protein. The term 'concentrated commercial feeding stuffs,' as used in this act, shall include linseed meals, cotton seed meals, gluten meals, maize feeds, starch feeds, sugar feeds, dried brewers' grains, malt sprouts, hominy foods, cerealine feeds, rice meals, ground beef or fish scraps, and all other materials of similar nature, but shall not include hays and straws, the grinding together of pure whole grains, nor the unmixed meals made directly from the entire grains of wheat, rye, barley, oats, Indian corn, buckwheat or broom corn; neither shall it include wheat, rye, or buckwheat bran, or middlings not mixed with other substances, and sold separately as distinct articles of commerce. No foreign mineral substance, nor substance injurious to the health of domestic animals, shall be mixed with any feeding stuff sold, or offered, or exposed for sale in this State."

The law goes into effect on the 1st of October, 1901, and will, it is hoped, effectually prevent the adulteration of feeding stuffs that has been so largely practiced in the past.

JOHN HAMILTON,
Secretary of Agriculture.



COMMERCIAL FEEDING STUFFS IN PENNSYLVANIA.

The chemist in his examination of cattle foods, separates them into several principal groups of materials:

1. *Moisture*.

2. *Ash*, the mineral matter of the food that is left when it is burned.

3. *Protein*, the total nitrogenous material of the food, which is assumed to be entirely composed of substances like the white of egg (albumen) in their chemical and nutritive properties, and called *albuminoids* from this resemblance; but, in point of fact, in many foods, particularly the green and immature leaf and stalk crops and the root crops, a large part of the nitrogenous material is composed of crystallizable substances (non-albuminoids) of quite different nutritive value. The mature grain and stalk contain comparatively little of the non-albuminoids.

4. *Fiber*, the woody matter, forming the framework of plants.

5. *Nitrogen-free extract*, including starch, sugars, gums, plant acids, etc. This group with the fiber composes the carbohydrates of the food.

6. *Fats*, or more properly, the ether-extract. This is determined by extracting the dry food with ether, which takes out the fat with more or less of other materials; from the grain, little else; but from leaves, stalks, etc., relatively large quantities of coloring matters, waxes, etc.

Before any of these substances can be used, they must be dissolved by the digestive fluids of the mouth, stomach and intestines and taken up into the body. This process of solution and absorption is called *digestion*. The degree to which any of the above groups of food constituents is digested depends both upon the nature of the animal using the food, the nature of the individual substances of which the group happens to be made up in a given food, the mechanical condition in which it exists and the proportion which the group under consideration bears to the other groups of food substances present in the digestive tract at the same time. Thus, so-called "herbivorous" animals provided with a paunch, have greater power

of digesting fiber than is possessed by animals with a single, small stomach like the hog; the tender fiber of young plants, is more digestible than the hard, ligneous fiber of old, woody plants; the proteids of clover and timothy seeds are really quite digestible, but escape digestion in a horse's stomach, because the hard seed-coats of these small seeds fail to be broken by the animal's teeth and almost entirely prevent access of the digestive fluids to the proteids; and finally, the digestibility of protein is decreased when large quantities of carbohydrates are present in a ration. The percentage of a given group of materials that is removed from a given food by digestion is termed its *percentage of digestibility*, or sometimes, its *coefficient of digestion*.

The more important nutritive uses of the digested parts of these several food constituents may be briefly noted:

The ash materials supply the mineral salts of the bone, blood, muscle and other animal tissues.

The carbohydrates (fiber and nitrogen-free extract) and fat serve, when burned in the body, to maintain its temperature and supply of energy. For this purpose, the fat is 2.25 times as valuable as the carbohydrates. Both of these groups are also capable of forming body-fat. The protein alone is able to supply the nitrogenous substances forming the organic matter of bone, blood, muscle, nerve, skin, wool, milk-curd and egg-albumen.

To permit a more perfect distinction of food values in the commercial feeding stuffs, the average composition of a number of the more common cattle food products of a Pennsylvania farm is given below:

Composition and Nutritive Ratios of Farm Feeds, Pennsylvania.

	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Nutritive ratios.
Green Forage:							
Pasture grass,	73.37	2.46	5.82	4.85	11.81	1.69	1: 3.7
Timothy in blossom,	65.10	2.00	2.80	12.60	21.50	1.30	1:14.4
Clover in bloom,	72.70	2.20	4.20	6.50	13.40	0.90	1: 5.0
Hungarian grass in bloom, ..	62.70	2.16	3.22	10.78	20.08	1.06	1:11.6
Soiling rye,	76.60	1.80	2.60	11.60	6.80	0.60	1: 5.7
Soiling oats,	62.20	2.50	3.40	11.20	19.30	1.40	1: 9.1
Soiling corn, kernels glazed,	73.40	1.50	2.00	6.70	15.50	0.90	1:15.1
Corn silage,	79.10	1.40	1.70	6.00	11.10	0.80	1:16.5
Cured Forage:							
Corn stover,	42.20	2.70	4.50	14.30	34.70	1.60	1:17.4
Timothy hay,	14.20	4.40	5.20	28.10	44.60	3.00	1:16.2
Red clover,	20.90	6.60	11.50	24.70	53.00	3.30	1: 6.0
Hungarian grass,	7.70	6.00	7.50	27.70	49.00	2.10	.....
Wheat straw,	4.60	9.20	3.40	38.10	43.40	1.30	1:65.5
Rye straw,	7.10	3.20	3.00	38.90	46.60	1.20	1:69.2
Oat straw,	9.20	5.10	4.00	37.00	42.40	2.30	1:32.8
Buckwheat haulm,	9.90	5.50	5.20	43.00	35.10	1.30	*
Roots:							
Potatoes,	78.90	1.00	2.10	0.60	17.20	0.10	1:17.4
Mangel wurzels,	90.90	1.10	1.40	0.90	5.50	0.20	1: 4.9
Sugar beets,	86.50	0.90	1.80	0.90	9.90	0.10	1: 6.8
Turnips,	90.50	0.80	1.10	1.20	6.20	0.20	1: 7.7
Rutabagas,	88.60	1.20	1.20	1.30	7.50	0.20	1: 8.5
Grain:							
Dent corn, kernel,	10.60	1.50	10.30	2.20	70.40	5.00	1:12.1
Oats,	11.00	3.00	11.80	9.50	59.70	5.00	1: 5.8
Rye,	11.60	1.90	10.60	1.70	72.50	1.70	1:11.0
Barley,	10.90	2.40	12.40	2.70	69.80	1.80	1: 8.0
Wheat, winter,	10.50	1.80	11.80	1.80	72.00	2.10	1: 9.9
Buckwheat,	12.60	2.00	10.00	8.70	64.50	2.20	1: 7.0

* No data on record.

By the term *nutritive ratio*, is meant the proportion which the protein bear to the starch equivalent of the nitrogen-free extract, fiber and fat in the digestible portion of any food-stuff, the protein being taken as 1. This starch equivalent is calculated by the addition of the quantities of digestible nitrogen-free extract and fiber to two and one-fourth times the quantity of digestible fat; this increase in the case of the fat being due to its exceptional heat producing power, to which reference has already been made.

The results of many decades of farm experience and of recent accurate scientific investigations show that the value of a ration to produce a specific result, such as the development of the young animal, the production of lean meat, or of fat, the enlarged or continued flow of milk, or, especially, working capacity, depends very materially upon the nutritive ratio of the food consumed.

As illustrations of the ratios found in foods that experience has proven to possess especial value for the several purposes above mentioned, the following may be cited:

1. Oxen at rest in the stall,	1:12.0
2. Fattening oxen, main period,	1:5.5
3. Fattening swine, main period,	1:6.0
4. Growing cattle, 2 to 3 months old,	1:4.7
5. Growing cattle, 18 to 24 months old,	1:8.0
6. Milk cows,	1:5.4
7. Wool sheep, finer breeds,	1:8.0
8. Horses, moderately worked,	1:7.0
9. Horses, heavily worked,	1:5.5

Comparison of these ratios with those of the feeding stuffs of domestic production at once shows that so long as pasture is abundant, growing animals, milk cows and work horses can readily secure the food fitted for their use. In the earlier days of American agriculture, little more than mere maintenance of farm animals was attempted during the winter months. For this purpose, the hay of timothy and other true grasses, corn stover and oat straw as roughage and corn and the more costly oats as grains, served excellently well; the latter grain being chiefly reserved, however, for the feeding of driving horses and possibly the family cow. The problem of securing a fitting food is much more difficult, however, in these days of intensive farming with restricted pasturage areas; of winter dairying with the consequent winter feeding of the calves that are reserved for raising; and of increased demand for lean as contrasted with fat meat.

The use of the process of ensilage in connection with intensive farming and winter dairying has ensured a supply of succulent food with valuable dietetic results, but, as it is usually conducted, has not materially improved the nutritive ratio of the average ration. The employment, also, of immature **soiling** crops in the spring and early summer, at a time when pastures are not yet ready to receive the herds and flocks, has reduced somewhat the period during which the wide-ratio roughage must chiefly be relied upon. The substitution of roots for any large portion of the ration is not esteemed practicable with the small animals preferred in America for dairy purposes, because of the bulky nature of the food, as well as because of its comparatively high cost. The use of clover and similar legumes for the purpose of securing narrower nutritive ratios in the rations of working, growing and milk-producing animals has very largely increased, with highly advantageous results in quality and yield of product; but a limit is speedily reached in practice beyond which the substitution of clover for corn stover or corn silage and for a portion of the grain food is not advantageous to the animal and is not economical of the entire product of any known general system of farming in America, where the corn crop is so important a part of every widely accepted rotation.

Consequently, there has arisen, within the last few decades, an increasing demand for concentrated feed stuffs—that is, such as are of relatively little bulk and are, in very large measure, digestible—more especially, for such as are rich in protein. To supply this demand, a great trade in such materials has developed; the centralization of the milling operations of the Northwest has resulted in the formation of large stocks of wheat by-products for which the grain farms of the West offer no market, but which move readily eastward to the points of greater demand. The introduction of new methods of manufacture has made possible the utilization for distant markets of the by-products from the manufacture of beer and spirituous liquors, of starch, glucose and cereal breakfast foods, so that to-day the farmer has offered for his use not only large quantities of concentrated feed-stuffs, but materials of great variety of source, composition and dietetic value.

It is not the purpose of this bulletin to discuss the nutritive and dietetic values of the several materials, but rather to briefly consider their nature and the composition which they exhibit in the Pennsylvania markets; especially to determine the variations appearing in the amounts of important constituents and to compare them with those observed in New York and New England. For New York, New Jersey, Maine, Massachusetts, Rhode Island and Connecticut have required that dealers in such materials shall stamp upon the packages containing them a guarantee of composition, analogous to that which most States require from dealers in fertilizers, and have provided for a control analysis of the feeding stuffs.

The samples whose analyses are recorded below were taken by agents appointed by the State Department of Agriculture, and the analytical work has been performed under the direction of the writer, by Messrs. M. S. McDowell and M. H. Pingree, Assistant Chemists of the Experiment Station, in accordance with arrangements made between the Secretary of Agriculture and the Advisory Committee for the Experiment Station. For the purposes of this examination, determinations of the protein and fat were all that were deemed necessary in most cases. These determinations were made by the official methods, except that the feeding-stuffs were not dried in a current of hydrogen.

The fact that the analytical examination has been confined in most instances to these two indicative constituents, must not be made a ground for disregarding in the selection of market feeding-stuffs, the nutritive value of the fiber and other carbohydrates, nor further must it be assumed that concentrated feeds, though different in the quantities of carbohydrates they contain, are essentially alike as regards the nutritive quality of these constituents. In general, starch and sugar are more highly digestible than fiber, gums and

related materials and probably have, for equal quantities of digested substance, a higher nutritive effect. The following table compiled by Jordan and Jenter,* well presents the more striking differences:

Carbohydrate Relations in Dry Matter of Several Feeding Stuffs.

	Sugars and starch.	Total nitrogen-free extract.	Sugars and starch in nitrogen-free extract.	Digestibility of the nitrogen-free extract.
Wheat, entire grain, Stone,	57.9	77.7	74.6	.....
Wheat, entire grain, Wiley,	72.5	78.5	92.4	.....
Maize, entire grain, Stone,	66.0	78.0	84.6	93
Oats, entire grain, Wiley,	50.9	66.3	76.8	83
Mixture, maize and oats, equal parts,	58.4	72.1	81.0	.....
The Gluten Products:				
Gluten meal,	38.2	49.8	76.7	93
Buffalo gluten feed,	27.3	58.3	46.8	84
Davenport gluten feed,	29.8	60.9	48.9	.....
Diamond gluten feed,	31.6	61.6	51.3	.....
Joliet gluten feed,	34.0	66.0	51.5	.....
Peoria gluten feed,	28.9	59.8	48.3	90
The Oil Meals:				
Cotton-seed meal,	16.0	27.9	57.4	50
Linseed meal, old process,	13.2	29.2	33.7	78
Linseed meal, new process,	20.8	40.8	51.0	84
Malt sprouts,	23.1	49.6	46.6	69
Buckwheat middlings,	27.3	48.3	56.5	.....
Wheat bran,	23.6	60.5	39.	69
Wheat middlings,	38.8	64.2	60.4	85
Hominy feed,	50.1	72.7	68.9	.....
H. O. dairy feed,	34.6	60.4	57.3	.....
Oat feed,	29.4	61.5	47.8	60
Victor feed,	43.0	70.3	61.2	.....
Chop feeds,	47.5	73.5	61.6	.....
X oat feed,	16.1	57.9	27.8	.....

In the presentation of the results of their work, the Massachusetts and New York Stations have followed a classification of feeding-stuffs based upon their composition. The modified form adopted in New York is as follows:

Class I. Thirty to 45 per cent. protein and 50 to 60 per cent. carbohydrates, including cotton-seed meal, linseed meal and the gluten meals, such as the Chicago, King, Cream and the Hammond.

Class II. Twenty to 30 per cent. protein and 60 to 70 per cent. of carbohydrates, including gluten feeds, such as the Buffalo, Golden, Diamond, Davenport, Climax and Standard, as now made, Atlas meal, dried brewers' grains, malt sprouts, buckwheat middlings and peas and beans.

Class III. Fourteen to 20 per cent. of protein and 70 to 75 per cent. of carbohydrates, including brans and middlings from wheat and rye, certain so-called mixed feeds of a proprietary character, these being in part oat feeds fortified with some more highly nitrogenous material.

*Bulletin No. 166, N. Y. Agricultural Experiment Station, Geneva, p. 262.

Class IV. Eight to 14 per cent. of protein and 75 to 85 per cent. of carbohydrates, including barley, corn, oats, rye, wheat, cerealine, hominy and oat feeds, corn and oat chops, corn bran, corn germ feed and chop feed in general.

For the purpose of this bulletin it is, however, preferred to discuss these products in relation to the raw materials from which they are severally derived.

COTTON-SEED MEAL.

This is manufactured from the seed of the cotton-plant. The seed is tufted by a thick coat of lint, which is exposed, as the plant ripens, by the opening of the boll or pod. The lint which forms the cotton of commerce is removed from the seed by the operation of ginning, although a considerable quantity of short lint still clings to the seed coat. The proportion of seed in upland cotton* is about 2 to 2.2 pounds for each pound of lint, in sea-island cotton,† 2 to 2.5 pounds. The supply of this material is therefore very abundant. The fuzzy seed from the ginning process is then subjected to a rough milling process for the removal of the black hull from the oval seed. The hull is further worked to secure the small amount of lintel adhering. The decorticated seed—that is, that from which the hull has been removed—is then cooked, placed in jute sacks and subjected to heavy pressure in powerful hydraulic presses, whereby a portion of the oil is expressed. The press cakes, the “cotton-seed cake” of commerce, are afterward fine ground, yielding the cotton-seed meal. The average theoretical yield, as compared with the average milling product, is as follows:‡

	Theory, per cent.	Mill product, per cent.
Oil,	20.00	12.5
Meal,	30.00	37.5
Hulls,	40.00	48.9
Lintel,	10.00	1.1
	100.00	100.00

* McBryde, Bulletin Tenn. Agr. Exp. Sta., Vol. IV, No. 5, pp. 127 and 129.

† Shiver, Bulletin, S. C., Agr. Exp. Sta., No. 47, p. 34.

‡ Statistics of X Census: Quoted in Bulletin Tenn. Agr. Exp. Sta., IV, No. 5, pp. 128-9.

These figures clearly show that fully 37.5 per cent. of the seed-oil remains in the press-cake and that the recovery of the lintel from the hull is very imperfect, being barely one-ninth of the amount present.

The relative composition of the undecorticated seed, the hull and the cotton-seed meal are as follows:*

	Seed, per cent.	Hull, per cent.	Meal, per cent.
Moisture,	7.71	11.30	7.47
Composition of dry matter:			
Ash,	2.40	3.30	7.60
Protein,	16.81	5.19	51.12
Fiber,	28.27	43.85	4.90
Nitrogen-free extract,	31.70	45.31	26.37
Fat,	19.82	2.35	10.01
	100.00	100.00	100.00

Hand-separated hulls contain only half as much protein and one-fourth as much oil. The milling operation results in a tearing away of a portion of the true kernel with the hull.

Good cotton-seed meal is yellow in color with a greenish tinge and possesses a pleasant nutty odor. On aging, it darkens, especially under conditions rendering it rancid or musty. Dark color indicates a possible admixture of black cotton-seed hulls, but not all dark colored samples are thus adulterated. Another impurity reported is an admixture of wastes from rice mills.

At a recent convention in New Orleans, the cotton-seed oil producers adopted the following rules:

"17. A ton of cotton-seed meal is 2,000 pounds, unless otherwise stated. A sack of cotton-seed meal is 100 pounds gross weight.

"Cotton-seed meal shall be classed and graded as follows:

"18. Choice. Must be the product from choice cotton-seed cake when finely ground, must be perfectly sound, sweet and light yellow color (canary), free from excess of lint and hulls. Analysis must contain at least 8 per cent. of ammonia.

"19. Prime. Must be made from prime cake, finely ground, of sweet odor, reasonably bright in color, yellow, not brown, or reddish, and free from excess of lint or hulls and by analysis must contain at least 8 per cent. of ammonia.

"20. Off. Any cotton-seed meal which is distinctly deficient in any of the requirements of prime quality, either in color, odor, texture or analysis, or all."

* Bulletin Tenn. Agr. Exp. Sta., IV, No. 5, p. 144.

The following samples of cotton-seed meal were taken in Pennsylvania, this season, by Department agents:

No.	Name of Brand.	Manufacturer.	Dealer.	Price per ton.
147	Cotton-seed meal,	American Oil Co., N. Y. City,	Snyder Bros., Dalton Pa.,	\$26 00
32	Cotton-seed meal,	E. B. Williams & Co., Memphis, Tenn.	J. P. Sandt, Easton, Pa.,	30 00
125	Cotton-seed meal,	E. B. Williams & Co., Memphis, Tenn.	C. H. Sears, Clark's Summit, Pa.,	27 00
209	Cotton-seed meal,	E. B. Williams & Co., Memphis, Tenn.	Wm. Fisher,	27 00
93	Cotton-seed meal, .....	.....	J. Watson Craft, Ambler, Pa.,	30 00
106	Cotton-seed meal, .....	.....	Maryland Grange Agency, Balto., Md.,	26 00
110*	Cotton-seed meal, .....	.....	Morris Briggs, Woodburn,	27 00
111	Cotton-seed meal, .....	.....	Trenton Milling Co., Morrisville,	27 00

* Musty, having become damp in the warehouse.

Their percentage, composition and other data for comparison are given below:

Number.	Moisture.	Protein.	Fat.	Remarks.
147,	6.41	42.50	12.25	
32,	6.76	46.69	9.28	
125,	7.62	45.25	9.82	
209,	7.31	44.69	10.06	
93,	8.88	43.69	8.77	
106,	7.09	44.50	9.89	
110,	7.11	43.31	11.26	
111,	6.91	44.56	9.48	
Average,		44.40	10.10	

Microscopic examination fails to reveal any foreign substances or any distinct excess of hulls; recent New York and Massachusetts examinations have detected such adulteration.

Comparison of these goods with those sold elsewhere may be made as follows:

	Number of analyses.	Protein, Per Cent.			Fat, Per Cent.		
		Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
Pennsylvania analyses,	8	46.09	42.50	44.40	12.25	8.77	10.10
New England analyses, 1898-99, ..	205	52.6	40.2	45.4	17.0	6.5	11.2
New York analyses, 1898-99,	14	50.69	41.68	45.64	12.16	7.56	10.82

The average superiority of the goods sold in New York and New England in 1898-9, is shown by analyses reported in Bulletin No. 166 of the New York Experiment Station and summarized in Bulletin No. 130 of the Connecticut Agricultural Experiment Station.

LINSEED MEAL.

The seed of the flax plant is also rich in a peculiar oil, possessing in marked degree the power of absorbing oxygen from the air and thereby becoming hard and resinous—a property fitting it especially for use in making paints and oil varnish. The oil is contained, together with an abundance of protein, in the inner portion of the seed, the endosperm, or reserve food-supply for the developing embryo. The flat, shining seeds, dark brown in color, form, if mature, a slimy layer when left in contact with water. This is due to a transformation of the outer layers of the seed-coat into mucilage. One of the dark inner layers of the seed-coat carries considerable tannin. Owing, however, to the other constituents, the seed has a markedly soothing and slightly laxative effect. The composition of the entire seed is, according to Kuehn:*

	Per cent.
Water,	11.8
Ash,	3.4
Protein,	21.7
Fiber,	7.9
Nitrogen-free extract,	19.6
Fat or oil,	35.6
	<hr/>
	100.0
	<hr/>

There are two general processes for the separation of the oil from the crushed seed. The older process involves the pressure of the seed-meal by hydraulic presses. The operation is more complete when the seed-meal is first cooked, though the oil takes out more resin and coloring matter and, if too high a temperature is reached, the protein is modified and becomes somewhat less digestible. Meals from linseed cake prepared in this manner, are called “old process” meals and rarely, if ever, contain less than 3.5 per cent. of oil, the warm-pressing usually removing but 27 to 28 per cent. of the oil.

*Pott, Ldw, Futtermittel, p. 442-3.

The "new process" is one of extraction by means of volatile solvents, such as carbon bisulfid or gasoline, more generally the former. The meal is placed in a large chamber and streams of the solvent are caused to slowly trickle through the mass, dissolving and extracting the oil, which is then recovered by evaporation of the solvent. The extracted meal is likewise freed from all traces of the solvent. Less than 3.5 per cent. of oil is commonly left in the meal, and sometimes less than 2 per cent. In general, the "new process" meal contains about 4.75 per cent. less oil than the "old process" meal and, correspondingly, 2.5 per cent. more protein. There is no ground for the quite frequent belief that there is an injurious chemical left in the meal treated by the extraction process.

The meal, as prepared by either of the above processes, is of a grayish-brown color and contains numerous dark-brown or black particles of the seed-coat.

The following samples were gathered by Department agents for examination:

"Old Process" Meals.

No.	Brand.	Manufacturer.	Dealer.	Price per ton.
229	Linseed meal, dry,	Armstrong & McKelvie, Pittsburgh, Pa.	McClelland & Siple, ..	\$35 00
236	Linseed meal, dry,	Armstrong & McKelvie, Pittsburgh, Pa.	Byrne & Steele,	40 00
237	Linseed meal, dry,	Armstrong & McKelvie, Pittsburgh, Pa.	Charles Friel,	40 00
76	Linseed meal,	Cleveland Linseed Meal Co., Cleveland, O.	Warner Bros., Grant, N. Y.,	33 00
264	Linseed meal,	Cleveland Linseed Meal Co., Cleveland, O.	L. Brant, Harrisburg, Pa.,	30 00
92	Cake meal,	J. Watson Craft, Ambler, Pa.	J. Watson Craft, Ambler, Pa.,	30 00
54	Linseed meal,	Gibson Bros., Philadelphia...	Mahlon C. Dietrich, Kempton, Pa.,	30 00
30	Linseed oil meal,	John T. Lewis & Bros. Co., Philadelphia.	J. P. Sandt Easton, Pa.,	30 00
275	Linseed oil meal,	A. B. Orr, Linseed Oil Co., Pequea, O.	A. S. Somes, Halifax, Pa.,	30 00
246	Linseed meal,	Pain Bros. & Co., Milwaukee, Wis.	D. H. Beebe, Corry, Pa.,	26 90
72	Oil meal,	Thompson & Co., Allegheny, Pa.	King Bros., Uniontown, Pa.,	20 00
74	Oil meal,	Thompson Linseed Oil Co., Pittsburgh, Pa.	G. L. Moore, Brownsville,	28 00
212	Linseed meal,	Thompson & Co., Allegheny, Pa.	C. Beckert, Pittsburgh, Pa.,	30 00
217	Linseed meal, dry,	Thompson & Co., Allegheny, Pa.	W. H. Cleland, Pittsburgh, Pa.,	35 00
234	Linseed meal, dry,	Thompson & Co., Allegheny, Pa.	Peter Bock, Pittsburgh,	36 00
239	Linseed meal, dry,	Thompson & Co., Allegheny, Pa.	C. Kellner, Allegheny, Pa.,	30 00
95	Cake meal,	Toledo Mills, Toledo, O.,	W. H. Heebner, West Point, Pa.,	27 00
22	Oil meal, .....	.....	Penn Traffic Co., Ltd., Johnstown, Pa.,	60 00
25	Oil or cotton-seed(?), ..	.....	Widman & Sheeler, Johnstown, Pa.,	28 00
130	Linseed oil meal, .....	.....	Snyder Bros., Dalton,	25 00
132	Linseed meal, .....	.....	Weston Mill Co., Scranton, Pa.,	25 00
133	Linseed meal, .....	.....	C. H. Sears, Clark's Summit, Pa.,	32 00
257	Oil meal, .....	.....	F. L. Heath, Corry, Pa.,	30 00
259	Oil meal, .....	.....	Bliss & Merrick, Corry, Pa.,	30 00
279	Linseed meal, .....	.....	C. F. Dyer, Millersburg, Pa.,	30 00

"New Process" Meals.

No.	Brand.	Manufacturer.	Dealer.	Price per ton.
86	Linseed meal,	Cleveland Linseed Oil Co.,	Simpson Bros., Norristown, Pa.,	\$27 00
96	Linseed meal,	Cleveland, O.	W. H. Heebner, West Point, Pa.,	25 00
83	Linseed meal, .....	.....	Warren Mills Co., Warren, Pa.,	31 00

Analyses of Linseed Meals.

Number.		Moisture, per cent.	Protein, per cent.	Fat, per cent.
"Old Process" Meals.				
229	.....	8.22	36.13	6.08
236	.....	8.15	34.94	6.37
237	.....	8.54	35.38	5.37
76	Average, Armstrong & McKelvie,	(8.30)	(35.48)	(5.34)
264	.....	9.74	32.94	6.61
92	Average, Cleveland Linseed Oil Co.,	(9.13)	(31.97)	(6.36)
54	.....	8.43	31.00	6.10
30	.....	9.77	36.31	6.07
275	.....	8.73	30.00	8.60
246	.....	8.02	34.94	6.13
72	.....	8.54	33.56	5.83
74	.....	8.19	37.69	3.63
212	.....	8.94	34.81	5.11
217	.....	8.53	35.00	5.97
234	.....	8.26	35.44	4.00
239	.....	8.80	34.70	3.54
95	.....	7.95	37.81	6.93
22	.....	8.34	37.00	7.09
25	Average, Thompson & Co.,	(8.47)	(35.79)	(5.41)
130	.....	9.98	32.06	8.88
132	.....	8.85	34.44	5.71
133	.....	9.14	33.44	5.96
257	.....	8.05	36.50	5.38
259	.....	8.60	29.81	5.26
279	.....	8.28	29.69	7.04
Range, .....	.....	8.98	33.75	6.92
Average, excluding No. 259, .....	.....	9.32	14.69	4.39
Average, .....	.....	8.51	31.00	6.43
Range,	7.95-9.98	14.69-37.81	3.54-8.88	
Average,	8.64	34.10	6.04	
Average,	8.67	33.32	5.98	
"New Process" Meals.				
86	.....	10.41	34.00	2.19
96	.....	10.31	34.13	2.92
83	Average, Cleveland Linseed Oil Co.,	(10.36)	(34.07)	(2.56)
Range, .....	.....	9.79	34.63	2.77
Average,	-9.79-10.41	34.06-34.63	2.19-2.92	
Average,	10.17	34.25	2.63	

Microscopic examination of these samples shows the presence of no very marked quantity of foreign substances except in case of No. 259. This sample, while it shows the presence of the characteristic tissues of the flax-seed, contains a very large proportion of dark-brown hulls, containing long woody fibers, and of clear white masses not found in flax-seed but like those of buckwheat bran; also, there is a noticeable quantity of chaff. The very low proportion of nitrogen in this sample is such as the substitution of most of the linseed meal by buckwheat bran would render probable.

Excluding this adulterated article, a comparison of these Pennsylvania samples with goods of this kind in general may be made:

	Number of analyses.	Protein, Per Cent.			Fat, Per Cent.		
		Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
Old Process Meal:							
Pennsylvania samples,	24	37.81	29.69	34.10	5.88	3.54	6.04
New England analyses,	25	38.9	31.8	35.7	9.6	2.7	7.2
1898-9,	14	38.19	28.69	35.74	8.86	5.72	7.19
New York analyses, 1898-9,...							
New Process Meal:							
Pennsylvania samples,	3	34.63	34.00	34.25	2.92	2.19	2.63
New England analyses,	31	42.2	39.6	38.2	3.5	1.8	2.4
1898-9,	5	37.56	35.19	36.14	4.79	2.91	3.57
New York analyses, 1898-9,...							

Here too, a very marked superiority is observed in the case of the average goods sold in New York and New England.

WHEAT PRODUCTS.

In the course of the manufacture of flour from wheat, bran, middlings and a number of products sold under other names are separated and sold as cattle foods. A brief consideration of the composition of the winter and spring varieties of the grain, of the structure of the wheat berry and of the essential differences in its parts as they are separated by the two prevailing types of milling will be helpful in getting a clear notion of the nature of the several market feeds prepared from this grain.

Jenkins and Winton* several years ago summarized the analyses extant of American winter and spring varieties of wheat, with the following results:

	Winter wheat (262 analyses), per ct.	Spring wheat (13 analyses), per ct.
Moisture,	10.5	10.4
Ash,	1.8	1.9
Protein,	11.8	12.5
Fiber,	1.8	1.8
Nitrogen-free extract,	72.0	71.2
Fat,	2.1	2.2
	100.0	100.0

* Bulletin No. 11, Office of Experiment Stations, U. S. Department of Agriculture.

Richardson* made 208 partial analyses of winter wheats from the Atlantic, Gulf and Middle States and of 33 samples of spring wheats from Minnesota, Dakota and Manitoba; the respective protein averages are 11.47 and 14.07 per cent. These data indicate an average of 13 to 13.5 per cent. of protein for spring wheats, an amount from one to two per cent. greater than that in winter wheats.

The structure of the wheat grain divides it into essentially four principal parts: 1. The epidermis or skin, including the hairs at the tip of the grain and three thin outer layers, weighing collectively about 3 pounds in 100 pounds of grain. 2. The color layer, composed of small cells containing two pigments, a yellowish and a red, according to whose relative predominance the color of the grain is "white," "amber" or "red." This forms 2 pounds in 100 pounds of grain. 3. The germ or embryo, located at the lower part of the grain and connected with a thin layer of tissue entirely enveloping (4) the *endosperm* or inner portion of the grain.

The outer layers are almost wholly composed of woody tissue. The germ is chiefly composed, on the other hand, of protein, oil and certain ash materials. The endosperm is not at all uniform in composition. At the center it is white and powdery, and is composed chiefly of starch enclosed in large, thin-walled cells. But toward the exterior of the mass of endosperm, the starch diminishes in proportion, and albuminoids, fats and ash become more abundant. The laxative materials of the endosperm, probably albuminoid in nature, also increase, relative to the other albuminoids, as the exterior is approached, and among the ash constituents, the lime grows relatively less, the magnesia more abundant.

The process of milling has for its object the powdering of the grain and the removal of the less desirable portions. The germ is removed because flours retaining it, tend, on standing, to darken and become ill-flavored. The outer layers are removed as bran. This is not, however, composed wholly of the epidermis and color layers, but also includes a large proportion of the endosperm, more especially of the outer, albuminoid layers of it. When separately prepared, these outer layers constitute the middlings, a dark flour making a "runny" dough. In general, the milling process commonly yields but 70 to 75 per cent. of flour and 25 to 30 per cent. of bran and middlings, including the germ, as its separation from other by-products is not common in many mills.

The character and proportion of the several milling products varies, of course, both with the character of the grain and the detailed method of milling. There are three principal methods of milling, two stone-milling processes and one roller process. Formerly, the flour was thoroughly ground by a single run through close-

*Bulletins 4 and 9, Chemical Division, U. S. Dept. of Agric.

set stones; complete purification was not possible by such a process. This was followed by high-milling, in which the grain was coarsely ground between stones less closely set, the fine flour bolted out, and the middlings then reduced by repeated grinding between more closely set stones. This latter process is excellently well adapted to soft winter wheat, but not so well to the harder spring varieties. For these, the roller process is best in which hardened steel rolls are employed to crack the brittle grain, the products of the several breaks being successively bolted as the grain goes between rolls more and more closely set. Besides the milling machinery proper, all good mills are to-day equipped with screening, blowing and brushing machines for the removal of foreign seeds, gravel and dust.

Teller* reports the distribution of materials in several milling operations: A. 7,000 pounds of mixed wheat; mill, 7 breaks, 40 bushels per hour capacity; B. Red wheat and C. Fulcaster, 3,000 pounds of each on a small 4-break mill of 7 bushels per hour capacity.

Yield of Parts in Percentages.

	A.	B.	C.
Patent flour,	12.11	17.65	25.80
Straight flour,	56.63	50.35	42.00
Low grade flour,	3.55	2.32	3.87
Shorts,		1.10	
Dust-room contents, .....		.82	1.17
Bran,	23.37	24.10	23.80
Ship-stuff,	2.48		1.13
Tailings, .....			.33
Screenings,	1.1	2.70	1.83
Sample taken, .....		.05	
Loss, .....	.7	.91	.07

The proportions of "patent" and "straight" flours differ much in the several cases, but the entire yields of good quality flour in the three trials are respectively 68.74, 68.00 and 67.80, figures agreeing excellently well. The quantities of epidermis, germ, etc., classed as bran, also exhibit little difference. The names and proportions of the several minor by-products differ very much, however.

For the composition of the several products, analyses of those of the first two of the above milling tests will suffice:

* Bulletin 42, Arkansas Experiment Station.

Composition of Milling Products from Wheat.

	Grain.	Patent flour.	Straight flour.	Low grade flour.	Shipstuf.	Dust room products.	Bran.	Germ.
A. Mixed Wheat :								
Water,	13.90	13.75	13.90	13.22	12.25	.....	12.85	6.80
Ash,	2.15	.33	.47	.90	3.12	.....	5.80	4.65
Protein,*	12.31	9.69	10.37	12.88	16.36	.....	15.56	36.00
Fiber,	2.17	.17	.26	.74	3.55	.....	6.14	1.60
Nitrogen-free ex- tract,	63.32	75.01	73.75	70.56	59.02	.....	54.45	36.55
Fat,	2.15	1.05	1.25	1.70	4.80	.....	5.20	14.38
B. Red Wheat :								
Water,	13.70	14.05	14.04	13.90	13.50	12.04	12.55	.....
Ash,	1.85	.26	.35	.78	1.21	2.81	5.85	.....
Protein,*	11.40	8.49	9.80	13.79	14.82	12.65	6.30	.....
Fiber,	2.03	.17	.22	.54	.98	6.06	6.51	.....
Nitrogen-free ex- tract,	69.17	76.10	74.32	69.19	66.99	62.29	53.99	.....
Fat,	1.85	.93	1.27	1.80	2.50	3.15	4.80	.....

*In these analyses estimated as 5.7 times the percentage of nitrogen found.

The five products last named are sold largely or exclusively as cattle-foods, either under the above names or under others.

Red-dog flour is the name given to the poorest grade of flour, so named because it is "off color."

The term "*middlings*" is used by some manufacturers to cover everything except the high-grade flours and bran; in many cases, indeed, a very considerable proportion of bran is included in the product. *Shorts* and *ship-stuff* are terms applying to somewhat varying grades of middlings, the former being, in fact, closely related to bran, but containing less fiber and ash.

The terms *mixed feed* or *wheat feed* are applied to mixtures of middlings, bran and other "wheat offals," and, in some instances, are in part composed of "red dog."

Owing to the wide latitude in the use of the several trade names of milling products, it is clear that the purchaser can have from the name alone, only a very imperfect idea of the composition and nutritive value of the various wheat offals, especially those sold as middlings and as mixed feed.

Furthermore, even in the case of brans, the Connecticut and Massachusetts controls have found a considerable amount of adulteration, admixtures of corn-cob and wastes from broom-corn being introduced. The latter control states that this was particularly true of certain brans brought from Tennessee and Kentucky.

The following samples of wheat products were submitted by Department agents during the current year:

Wheat Grain.

No.	Brand.	Manufacturers.	Dealers.	Cost per ton.
144	Scorched wheat for poultry.	Empire Grain and Elevator Co., Binghamton, N. Y.	Snyder Bros., Dalton, Pa.,	\$21 00

Upon analysis, this sample showed:

	Moisture, per cent.	Protein, per cent.	Fat, per cent.
Average winter wheat,	9.75 10.50	12.69 11 80	2.01 2.10

The grain has evidently suffered little deterioration of its nutritive value by scorching.

Wheat Bran.

Of wheat bran, the Department agents submitted 38 samples. In the majority of instances, no designation as to the character of the wheat from which the sample was derived, whether "winter" or "spring," was given. Such brans are grouped together. The samples received were as follows:

No.	Manufacturer.	Dealer.	Price per ton.
<i>Winter Brans.</i>			
277	C. F. Dyer, Millersburg, Pa.,	L. T. Slight,	\$20 00
201	Hunter Bros., St. Louis, Mo.,	Chas. Friel, Pittsburg,	22 00
33	Milton Floury, Walters, Pa.,	C. W. Walter, Walters,	19 00
211	Warwick & Justice, Massillon, O.,	Peter Bock, Pittsburg,	20 00
27	.....	Penn Traffic Co., Ltd., Johnstown, Pa.,	20 00
<i>Spring Brans.</i>			
179	Dwight M. Baldwin, Jr., Graceville, Minn.,	Geo. O. Wilt,	18 00
222	C. A. Foster, Carnegie, Pa.,	McClelland & Siple, Pittsburg,	20 00
262	Full Frank Grain Co., Milwaukee, Wis.,	Cyrus Romberger, Lykens,	18 00
273	N. W. Consolidated Milling Co., Minneapolis, Minn.,	A. S. Somes, Halifax,	19 00
281	G. D. Stevens & Co., Minneapolis, Minn.,	A. M. Pike, Halifax,	20 00
124	Washburn, Crosby Co., Minneapolis, Minn.,	Snyder Bros., Dalton, Pa.,	19 00
119	Weston Mill Co., Scranton, Pa.,	Weston Mill Co., Scranton, Pa.,	20 00
266	.....	S. B. Vance, Middletown, Pa.,	20 00
268	.....	Joseph Burkholder, Hummelstown, Pa.,	19 00

No.	Manufacturer.	Dealer.	Price per ton.
<i>Brans not Classified.</i>			
105	D. P. Barber & Sons, Minneapolis, Minn.,	W. K. Heebner, West Point, Pa.,	18 00
176	Bare Milling Co., Roaring Springs, Pa.,...	Bare Milling Co., Roaring Springs, Pa.,	18 00
255	Bliss & Merrick, Corry, Pa.,	Bliss & Merrick, Corry, Pa.,	18 00
171	Clapper Bros., Martinsburg, Pa.,	Clapper Bros., Martinsburg,	19 00
187	Clapper Bros., Martinsburg, Pa.,	Clapper Bros., Martinsburg,	17 00
248	Densmore Bros., Erie, Pa.,	Densmore Bros., Erie, Pa.,	17 00
66	Eclipse Milling Co., Brownsville, Pa.,	Eclipse Milling Co., Brownsville, Pa.,..	19 50
71	Gaddis Co., Uniontown, Pa.,	M. H. Clark, Uniontown, Pa.,	20 00
60	David Hartz, Morgantown, Pa.,	David Hartz, Morgantown,	19 00
244	Frank L. Heath, Corry, Pa.,	Frank L. Heath, Corry, Pa.,	18 00
199	Hunter Bros., St. Louis, Mo.,	Byrne & Steele, Pittsburg, Pa.,	20 00
159	F. & I. Mentzer, Frankstown, Pa.,	F. & I. Mentzer, Frankstown, Pa.,	18 00
2	Northwestern Milling Co., Minneapolis, Minn.	L. Read, Chambersburg, Pa.,	17 00
221	Pittsburg Milling Co., Pittsburg, Pa.,	Wm. Fisher, Pittsburg, Pa.,	18 00
104	Phi. H. Postal Milling Co., Mascoutah, Ill.	W. K. Heebner, West Point, Pa.,	19 00
44	Seaboard Milling Co., Reading, Pa.,	A. N. Kissinger & Son, Reading, Pa., ..	19 00
56	Shaffer, Wanner & Co., Fleetwood, Pa., ..	M. C. Dietrich, Kempton, Pa.,	19 00
218	J. W. Smith & Co., Pittsburg, Pa.,	M. E. Coleman, Pittsburg, Pa.,	21 00
6	Truesdale & Speer, Minneapolis, Minn., ..	Coyle & Diehl, Chambersburg, Pa., ...	17 00
8	.....	B. A. Betts,	19 00
15	.....	Gustav Bostert, Johnstown, Pa.,	18 00
108	.....	Trenton Milling Co., Morrisville,	17 00
114	.....	Morris Briggs, Woodbury, Pa.,	18 00
223	(In Ohio),	C. Beckert, Allegheny, Pa.,	18 00

Percentage Composition of Brans.

Number.	Moisture.	Protein.	Fat.	Remarks.
<i>Winter Brans.</i>				
277,	9.13	15.56	3.92	
201,	9.11	15.31	4.04	
33,	9.89	14.13	4.34	Crude fiber, 8.85 per cent.
211,	10.44	16.50	4.04	
27,	9.46	14.44	4.94	Crude fiber, 11.10 per cent.
Range,	9.11-10.44	14.13-16.50	3.92-4.94	
Average,	9.43	15.19	4.26	
<i>Spring Brans.</i>				
179,	9.57	14.41	5.08	Crude fiber, 11.88 per cent.
222,	9.04	15.19	5.03	
262,	9.63	15.56	4.86	
278,	9.08	15.44	4.88	
281,	10.35	14.44	4.04	Crude fiber, 9.29 per cent.
134,	9.33	14.31	4.49	Crude fiber, 11.88 per cent.
119,	10.18	15.00	4.32	Crude fiber, 10.00 per cent.
266,	9.86	14.31	4.51	Crude fiber, 12.12 per cent.
268,	9.27	14.88	4.63	Crude fiber, 12.62 per cent.
Range,	9.04-10.35	14.31-15.44	4.04-5.08	
Average,	9.65	14.84	4.63	
<i>Brans not Classified.</i>				
105,†	10.59	16.94	4.89	
176,*	9.47	16.00	4.25	
255,*	9.80	15.06	4.38	Marked "coarse."
171,*	9.89	15.56	4.66	
187,*	10.66	14.06	3.73	Crude fiber, 7.90 per cent.
248,*	10.04	15.31	3.82	Marked "coarse."
66,*	9.72	15.94	3.92	
71,*	9.35	15.81	4.69	
60,*	10.56	16.31	3.71	
244,*	9.63	15.63	4.65	Marked "coarse."
199,*	10.13	15.31	4.43	
159,*	9.44	14.88	4.02	
2,†	10.68	14.94	4.42	Fiber, 9.50 per cent.
221,*	10.29	16.69	4.86	
104,†	10.34	15.94	4.78	

Number.	Moisture.	Protein.	Fat.	Remarks.
44,*	10.38	16.06	4.26	
56,*	10.47	14.06	4.36	
218,*	10.54	15.88	4.09	
6,†	9.83	15.38	5.02	
8,	9.89	14.31	4.66	
15,†	9.23	14.88	4.79	Fiber, 10.82 per cent.
108,	8.66	16.19	5.02	
114,	8.76	15.25	4.57	
223,*	10.01	15.06	4.30	
251,	9.75	15.69	4.86	
Range,	8.66-10.68	14.06-16.94	3.71-5.02	
Average,	10.02	15.49	4.45	
Range of all samples designated or supposed from location of mill to be winter wheat,	9.11-10.54	14.06-16.69	3.71-4.94	
Average,	9.88	15.40	4.26	
Range, spring wheat,	9.04-10.68	14.31-16.94	4.04-5.08	
Average,	9.82	15.12	4.70	
Range for all brans analyzed,	8.66-10.68	14.06-16.94	3.71-5.08	
Average,	9.54	15.30	4.48	

* Supposed from location of manufacture to be derived from winter wheat.

† Supposed from place of manufacture to be derived from spring wheat.

A microscopic examination of the foregoing samples revealed little of special interest except in a few cases:

No. 27 was quite dirty; a small quantity of oat hulls and the black hulls of a weed seed (*Polygonum dumetorum* var. *scandens*) in considerable quantity. This weed is related to buckwheat and its hulls, while of probably very slight food value, are not known to be directly injurious to animals.

No. 222 contains somewhat more oat hulls, but fewer weed seeds. The latter are chiefly *Polygonum*.

No. 262 shows rather more oat hulls; the amount is, however, probably under 5 per cent.

No. 8 contains some straw, though in small proportion.

These results indicate that the process of winnowing is not thoroughly carried out in all mills and that, in some mills, either very impure wheat is ground or oat hulls are added to the contents of the bran bin. In none of the above cases is the amount of impurity present such as to indicate a deliberate attempt to substitute other cheaper substances for bran; but lack of care for the purity of this feeding stuff is indicated.

Compared with the brans sold recently in neighboring States, the Pennsylvania samples make the following showing:

Comparison of Brans from Different States.

	Number of analyses.	Protein, Per Cent.			Fat, Per Cent.		
		Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
Winter Wheat:							
Pennsylvania,	5	16.50	14.13	15.19	4.94	3.92	4.26
New England States, 1898-9, ..	45	17.8	13.6	15.5	5.6	3.5	4.4
Spring Wheat:							
Pennsylvania,	9	15.44	14.31	14.84	5.08	4.04	4.63
New England, 1898-9,	53	17.5	15.1	16.1	5.6	4.4	4.9
All Varieties:							
Pennsylvania,	38	16.94	14.06	15.30	5.08	3.71	4.48
New England, 1898-9,	120	17.9	13.6	15.8	5.6	3.5	4.7
New York, 1898-9,	12	17.13	13.37	15.36	5.64	3.40	4.79

In general, the range of composition found in the Pennsylvania samples is not greater than was found to occur in New York during the first year of the operation of the food control law enacted by the latter State; but the brans sold in New England, where examinations of the cattle foods have been made for a longer period, show a quite distinct superiority in average composition.

Determinations of fiber were made in a number of instances where the proportion of protein fell below 14.5 per cent. The percentages of this constituent found in such cases vary from 7.90 to 12.62, quantities very similar to those obtained by Connecticut* in recent bran analyses.

The number of brans that were distinctly indicated to be spring and winter wheat brans respectively, is too small to afford a basis for comparison. A larger number of analyses reported sometime since by the Pennsylvania State College Agricultural Experiment Station,† exhibit a superiority in protein content for average spring bran exceeding that shown by the New England averages above indicated.

*B. 130, pp. 22-5.

† Bulletin 48, December, 1899.

Wheat Middlings.

There were selected by Department agents 35 samples of wheat middlings, exclusive of those designated as "ship stuff" and "red dog flour." The kind of wheat from which they were derived was specifically stated only in case of three samples from winter wheat. The samples selected were as follows:

No.	Manufacturer.	Dealer.	Price per ton.
164	Dwight M. Baldwin, Minneapolis, Minn.,	.....	\$21 00
196	Bare Milling Co., Roaring Spring, Pa.,	Bare Milling Co., Roaring Springs, Pa.,	.....
241	Bliss & Merrick, Corry, Pa.,	Bliss & Merrick, Corry, Pa.,	18 00
73	Champion Milling Co., Brownsville, Pa.,	L. C. Waggoner, Brownsville, Pa.,	20 00
166	Clapper Bros., Martinsburg, Pa.,	.....	20 00
193	Clapper Bros., Martinsburg, Pa.,	Clapper Bros., Martinsburg, Pa.,	18 00
284	C. F. Dyer, Millersburg, Pa.,	S. T. Slight,	20 00
226	Elkhart Swan Milling Co., Chicago, Ill.,	Wm. Fisher, Allegheny, Pa.,	17 00
126	Empire Grain and Elevator Co., Bingham- ton, N. Y.	Snyder Bros., Dalton, Pa.,	18 00
233	C. A. Foster, Carnegie, Pa.,	McClelland & Siple, Pittsburg, Pa.,	20 00
285	Full Frank Grain Co., Milwaukee, Wis.,	Cyrus Romberger, Lykens, Pa.,	19 00
69	Gaddis & Co., Uniontown, Pa.,	M. H. Clark, Uniontown, Pa.,	20 00
61	David Hartz, Morgantown,	David Hartz, Morgantown,	19 00
220	Hunter Bros., St. Louis, Mo.,	Chas. Friel, Pittsburg, Pa.,	22 00
228	Hunter Bros., St. Louis, Mo.,	C. Kellner, Allegheny,	19 00
230	Hunter Bros., St. Louis, Mo.,	Byrne & Steele, Pittsburg,	20 00
14	McDermott, Wertz & Co., Johnstown, Pa.,	McDermott, Wertz & Co., Johnstown, Pa.,	20 00
154	F. & I. Mentzer, Frankstown, Pa.,	.....	19 00
34	Milton Floury, Walters, Pa.,	C. W. Walter, Walters, Pa.,	20 00
1	Northwestern Co., Minneapolis, Minn.,	John Reside, Chambersburg,	18 00
215	Northwestern Elevator Co., Toledo, O.,	D. Whitmeyer, Allegheny, Pa.,	18 50
24	Pillsbury Milling Co., Minneapolis, Minn.,	J. C. Widman Shuler, Johnstown, Pa.,	18 00
216	Pittsburg Milling Co., Pittsburg, Pa.,	Branthoover Bros., Pittsburg, Pa.,	22 00
213	Pittsburg Milling Co., Pittsburg, Pa.,	Brown & Co., Pittsburg, Pa.,	22 00
45	Seaboard Milling Co., Reading, Pa.,	A. N. Kissinger & Son, Reading, Pa.,	20 00
51	Shaffer, Wanner & Co., Fleetwood, Pa.,	M. C. Dietrich, Kempton, Pa.,	21 00
46	Steelton Flour Mills Co., Steelton, Pa.,	A. N. Kissinger & Son, Reading, Pa.,	22 00
165	The George Tileston Milling Co., St. Cloud, Minn.	C. L. Hoof, Altoona, Pa.,	15 00
103	Trenton Milling Co., Trenton, N. J.,	Trenton Milling Co., Morrisville, Pa.,	17 00
7	Truesdale & Speer, Minneapolis, Minn.,	Coyle & Diehl, Chambersburg, Pa.,	17 00
79	Warren Mills Co., Warren, Pa.,	Warren Mills Co., Warren, Pa.,	18 00
203	Warwick & Justice, Massillon, Ohio,	Peter Bock, Pittsburg, Pa.,	20 00
120	Weston Mill Co., Scranton, Pa.,	Weston Mill Co., Scranton, Pa.,	20 00
103	E. S. Woodworth & Co., Minneapolis, Minn.	W. K. Heebner, West Point, Pa.,	19 00
18	.....	Gustav Dostert, Johnstown, Pa.,	19 00
20	.....	John Thomas & Co., Johnstown, Pa.,	18 00
75	(Cleveland, O.),	P. Davis, Sugar Grove, Pa.,	22 00
227	(In Ohio),	C. Beckert, Allegheny, Pa.,	19 00
260	.....	Joseph Burkholder, Hummelstown, Pa.,	19 00

Percentage Composition of Wheat Middlings.

No.	Description.	Moisture.	Protein.	Fat.	Remarks.
164†	Middlings,	10.58	17.44	5.31	
197†	Pure middlings,	11.31	12.94	2.81	Ash, 2.03 per cent.; fiber, 2.08 per cent.
241	Middlings,	9.75	14.31	3.72	Ash, 4.86 per cent.; fiber, 7.03 per cent.
73	Middlings,	10.90	12.88	3.20	Ash, 2.79 per cent.; fiber, 2.33 per cent.
166†	Middlings,	9.87	14.56	4.18	Ash, 3.49 per cent.; fiber, 4.26 per cent.
193†	Finished middlings,	10.05	15.75	4.18	
284*	Middlings,	10.08	17.94	5.58	
286	Brown middlings,	10.32	16.25	5.41	
126	Brown middlings,	9.61	14.81	5.10	
235	Wheat middlings, No. 2 white,	9.61	17.81	5.63	
264†	Western red middlings,	9.76	18.50	4.81	
69	Middlings,	10.50	15.06	3.43	
81†	White middlings,	12.10	13.13	1.85	Ash, 1.09 per cent.; fiber, 1.08 per cent.
220	Middlings, No. 2 white,	9.93	14.88	3.57	
228	Middlings, No. 2 fancy,	9.50	16.76	4.94	
230	Middlings, brown,	9.95	16.25	4.84	
14	Wheat middlings,	10.23	16.94	4.80	
154†	Middlings,	10.21	16.13	4.40	
34†	Wheat middlings,	11.33	13.94	3.62	Ash, 2.21 per cent.; fiber, 2.10 per cent.
11†	Middlings,	10.08	16.88	5.27	
215	Middlings, No. 2,	10.13	15.75	3.98	
24†	Brown middlings,	9.57	16.69	4.94	
215*	Winter wheat middlings,	10.28	15.88	4.24	
213	Middlings, No. 2,	10.29	17.13	4.53	
45	Red middlings,	10.81	16.69	5.38	
51†	Red middlings,	11.58	14.41	3.91	Ash, 2.479 per cent.; fiber, 2.63 per cent.
46†	White middlings,	10.98	17.13	4.66	
163†	Red middlings,	9.99	17.19	5.30	
109	Middlings,	9.03	16.69	5.97	
7†	Middlings,	9.24	16.38	5.89	
79	Wheat middlings,	11.43	14.75	4.46	
203*	Winter wheat middlings,	9.89	14.63	3.77	Ash, 4.03 per cent.; fiber, 5.49 per cent.
120	Wheat middlings,	9.16	17.50	6.26	
108†	Wheat middlings,	11.19	17.81	5.45	
18	No. 2 middlings,	9.64	17.06	4.63	
20	Brown middlings,	9.63	18.38	5.61	

75	"B" middlings,	10.59	16.75	5.86	
227	Brown middlings,	10.42	15.75	4.31	
260†	Western middlings,	10.42	14.63	4.04	Ash, 3.75 per cent.; fiber, 4.93 per cent.
	Range of composition of all samples,	9.24-12.10	12.94-18.50	1.85-6.26	
	Average composition,	10.26	16.05	4.60	
	Range of composition of samples (* & †) designated or judged by location to be from winter wheat (10 samples),	9.37-12.10	12.94-17.94	1.85-5.58	
	Average,	10.74	15.04	4.63	
	Range of composition of samples (‡) judged by location to be from spring wheat (10 samples),	9.24-11.19	14.63-18.50	3.98-5.89	
	Average,	10.11	16.81	5.00	

* Designated as from winter wheat. † Judged by location to be from winter wheat.

‡ Judged by location to be from spring wheat.

These samples compare with those analyzed, 1898-9, in New England and New York, as follows:

	Number of analyses.	Protein. Per Cent.			Fat. Per Cent.		
		Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
Pennsylvania,	39	18.50	12.94	16.05	6.26	1.85	4.60
New England,	135	22.2	12.4	17.0	7.1	2.6	5.0
New York,	14	20.06	14.81	17.76	6.51	3.90	5.53

In this case also, while the range of composition is not exceptionally wide, the average percentages of the more valuable materials are distinctly below those exhibited in States subject to a cattle-food control.

In nine samples whose protein was less than 14.75 per cent., determinations of fiber and ash were made with results ranging from 7.03 to 1.08 per cent. for fiber, and 4.86 to 1.90 per cent. for ash. Twenty-three samples analyzed in Connecticut in 1899, showed fiber, 10.31 to 1.05 per cent., and ash, 5.52 to 2.86 per cent., and fourteen samples analyzed in New York, the same year, showed fiber, 10.35 to 2.17 per cent., and ash, 5.10 to 2.52 per cent. Clearly, the low protein in the Pennsylvania samples is not attributable to excessive quantities of these two elements introduced by conspicuous additions of foreign matters. These analyses would not show the addition to a pure middlings of large quantities of the fluffy dust from the dust room, in which the hairs from the tip of the grain are deposited as a result of the modern milling processes.

The name attached to the brand gives no certain indication of feeding value. This is well exhibited by the range of protein content found in those specimens to which some particular grade name was given.

"Pure," "white," "finished,"	17.13 to 12.94 per cent.
"No. 2 white,"	17.81 to 14.88 per cent.
"Red,"	18.50 to 14.44 per cent.
"Brown,"	18.38 to 14.81 per cent.

The "white" middlings contain, of course, more starch than the "brown" middlings, bran being more abundant in the latter.

Microscopic examination with a low-power lens discovers no conspicuous foreign material except in case of No. 75, which is rendered quite impure by the presence of numerous weed seeds.

Wheat Shorts.

The "shorts," as previously explained, are chiefly composed of the same tissues of the wheat grain as those from which the bran is derived.

Three samples were taken bearing this specific name:

No.	Manufacturer.	Dealer.	Price per ton.
58	David Hartz, Morgantown, Pa.,	David Hartz, Morgantown, Pa.,	\$19 40
253	——, Middletown, Pa.,	S. B. Vance, Middletown, Pa.,	19 00
261	——, Minneapolis, Minn.,	J. B. Deckard, Middletown, Pa.,	20 00

The composition of these samples was found to be as follows (per cent.):

Number.	Moisture.	Protein.	Fat.
58,	9.88	18.31	5.97
253,	10.32	16.00	4.84
261,	9.59	15.25	4.72
Average,	9.93	16.52	5.18

Jenkins and Winton's compilation of American analyses made prior to 1892 shows the following figures (per cent.):

	Moisture.	Protein.	Fat.
Highest,	15.5	19.4	6.1
Lowest,	4.1	11.1	2.5
Average,	11.8	14.9	4.5

The Pennsylvania samples, while some are much richer in protein and fat than others, are well above the averages given by Jenkins and Winton.

Microscopic examination failed to show any adulteration.

Ship Stuff.

Of this variety of middlings, but one sample was examined:

No.	Manufacturer.	Dealer.	Price per ton.
265	J. B. Deckard, Middletown, Pa.,	\$20 00

Its percentage composition was as follows:

	Moisture.	Protein.	Fat.
Composition,	10.53	16.13	3.88

Red Dog Flour.

This low grade flour is often included with the middlings. Four samples were submitted for analysis:

No.	Manufacturer.	Dealer.	Price per ton.
180	Dwight M. Baldwin, Graceville, Minn., ...	Geo. P. Wilt, Duncanville, Pa.,	\$18 75
276	Pillsbury Co., Minneapolis, Minn.,	Cyrus Romberger, Lykens, Pa.,	19 00
273	G. D. Stevens, Minneapolis, Minn.,	A. M. Pike, Halifax, Pa.,	20 00
17	.....	Gustave Bostert, Johnstown, Pa.,	20 00

The results of analysis were as follows (per cent.):

No.	Description.	Moisture.	Protein.	Fat.
180	Red dog middlings,	10.16	17.94	5.28
276	Pillsbury red dog middlings,	9.54	20.25	5.77
273	Red dog flour,	10.16	19.13	4.72
17	"Daisy red dog,"	9.72	19.25	3.70
	Range of composition,	9.54-10.16	17.94-20.25	3.70-5.77
	Average,	9.90	19.14	4.87

The microscope reveals no foreign matters in these samples. This product is seen to contain considerably more protein than either of the wheat products already described.

Wheat Feeds.

Instead of selling the various products of the mill, other than flour, separately under their distinctive names as bran, middlings, etc., many millers combine several or all of these by-products and sell them under the name of "wheat feed." It is clear that quite a wide range of composition might be expected in a feeding-stuff of such varying method of preparation. Only three samples bearing this name were submitted by the Department agents. They were:

No.	Manufacturer.	Dealer.	Price per ton.
146	Empire Grain and Elevator Co., Binghamton, N. Y.	Snyder Bros., Dalton, Pa.,	\$19 00
136	C. H. Sears, Clark's Summit, Pa.,	C. H. Sears, Clark's Summit,	19 00
9	(Akron, O.),	J. L. Hockensmith,	20 00

The results of analysis were as follows (per cent.):

No.	Description.	Moisture	Protein.	Fat.	Fibre.
146	Spring wheat bran and middlings,	9.78	15.94	4.49	.....
136	Wheat feed, bran and shorts,	9.20	10.19	2.60	19.84
9	Buckeye wheat feed,	10.08	16.50	4.53	.....
	Range of composition,	9.20-10.08	10.19-16.50	2.60-4.53	.....
	Average,	9.69	14.21	3.90	.....

On examination under the microscope, the following facts appear:

No. 146. Bran is the chief constituent. The fine material contains many of the hairs which, in the best mills, go to the dust room. Some whole oats and oat hulls are present, but these form a very small percentage of the entire feed.

No. 136. While the bulk is chiefly composed of bran, the sample contains a large amount of fibrous material, finely divided and closely resembling, under a power of 50 diameters, the compact, fibrous structure and yellowish tint of corn cob. Some oat hulls were also present.

No. 9. Chief bulk composed of bran; the amount of middlings present is small; there is present a large amount of the hair from the tip of the grain, indicating a probable admixture of the dust room contents. A little oat hull appears, but is not conspicuous.

Only one of these brands has been analyzed in other States, viz: "Buckeye wheat feed." The composition shown by these analyses is as follows:

	Protein, per cent.	Fat, per cent
Connecticut (3 samples),	17.75-16.37	4.41-4.37
New York (1 sample),	15.38	5.12

The Pennsylvania sample is up to the average for the brand.

Wheat feeds, in general, as shown by 219 analyses of market feeds made in New England States, have the following range of composition:

	Protein, per cent.	Fat, per cent.
Highest,	20.0	5.8
Lowest,	14.0	3.6
Average,	16.6	4.7

The fiber in 48 samples recently analyzed in Connecticut, ranges from 5.20 to 9.41 per cent.

No. 136 shows a content of protein and fat far inferior to the minimum shown by the New England analyses for goods of this class. The material was therefore examined for fiber and found to contain fully twice as much as the maximum observed in such goods. A mixture of equal parts of average wheat feed and fine ground corn cob would contain, protein, 9.5 per cent.; fat, 2.6 per cent.; fiber, 18.5 per cent. These figures quite nearly approximate those found for No. 136.

Wheat Flour.

While not strictly coming within the list of cattle-foods, a sample of "Pillsbury's Best" wheat flour, manufactured by the Pillsbury & Washburn Co., of Minneapolis, Minn., and sold by Snyder Bros., Dalton, Pa., at \$4.60 per barrel, was submitted for analysis. Examined by the methods adopted in the preceding cases, it gave the following results:

No. 121. Moisture, 11.65; protein, 11.69; fat, .60.

RYE PRODUCTS.

Rye in both botanical and general chemical characters closely resembles wheat. When subjected to milling, it is separated into a series of products similar to those which wheat produces.

The composition of the entire grain is represented by analyses of 57 samples from various portions of the United States reported by Richardson.*

	Average, per cent.	Highest, per cent.	Lowest, per cent.
Moisture,	8.67	10.00	7.00
Ash,	2.09	3.72	1.31
Protein,	11.32	15.58	8.75
Fiber,	1.46	1.90	1.10
Nitrogen-free, extract,	74.52	77.54	68.74
Fat,	1.94	2.91	1.38
	100.00	.....	.....

* *Op. cit.*, Bull. 9, p. 57.

So that, in general, rye contains less protein and fiber and more starch than wheat. On account of both its nutritive value and dietetic effects, it and its products are particularly prized for feeding horses. Lavalard,* after numerous experiments with cab horses and those in the cavalry and artillery services of the French army, found the effects more variable than those of other grains and believes this is due to variability of composition.

The following samples of rye products were submitted:

No.	Manufacturer.	Dealer.	Price per ton.
<i>Rye Chop.</i>			
40	John D. Bieber, Oley, Pa.,	A. N. Kissinger & Son, Reading, Pa.,	\$25 00
195	C. E. Lingafelt, Hollidaysburg, Pa.,	C. E. Lingafelt,	25 00
12	McDermott, Wertz & Co., Johnstown, Pa.,	McDermott, Wertz & Co., Johnstown,	28 00
<i>Bolted Rye Chop.</i>			
270	Levi Brant, Harrisburg, Pa., .....	.....	25 00
<i>Rye Middlings.</i>			
29	Mann & Allshouse, Easton, Pa.,	Mann & Allshouse, Easton, Pa.,	18 00

The percentage composition of these feeding-stuffs was as follows:

No.	Description.	Moisture.	Protein.	Fat.	Remarks.
40	Rye chop,	11.49	9.63	2.19	Coarse.
195	Rye chop,	10.32	11.25	2.09	
12	Rye chop,	11.68	10.00	1.03	
	Range of composition,	10.32-11.68	9.63-11.25	1.03-2.19	
	Average composition,	11.16	10.29	1.77	
270	Bolted rye chop,	10.02	10.75	1.66	
29	Rye middlings,	9.63	13.66	3.36	

The microscope does not indicate any adulteration in these samples.

In composition, the chops fall well within the range of composition for whole grain given above, except the percentage of fat in No. 12, which is below the minimum there given. The composition of the middlings is normal; they are seen to have considerably less protein and fat than average wheat middlings.

BARLEY AND ITS BY-PRODUCTS.

Barley, though grown in America especially for malting purposes, is used in many countries as a horse feed, in place of oats. Lavalard† mentions such substitution as general in Italy, Spain and Algeria, where oats cannot be profitably raised.

* Experiment Station Record, **12** 16.

† *Ib.*, **14**.

Experiments made by the *Compagnie generale des omnibus* of Paris, with both draught and saddle horses during twenty years, show that while barley can replace oats in horse rations, a somewhat larger quantity must be employed; also that barley bran is very tough, with a tendency in inferior varieties to seriously lower the amount of digestible matter.

A study by Richardson* of sixty samples of barley grown in different parts of the United States gave the following results:

	Average.	Highest.	Lowest.
Composition (per cent.), whole grain:			
Water,	6.53	9.15	4.53
Ash,	2.89	4.43	1.50
Protein,	11.33	14.88	8.75
Fiber,	3.80	4.65	2.64
Nitrogen-free extract,	72.77	76.79	68.99
Fat,	2.68	3.54	2.06
	100.00		
Percentage of hull,	15.22	16.94	12.55
Weight per bushel (pounds),	54.0	67.9	48.5

No samples of this grain have been submitted for analysis; it enters, however, into the composition of a number of mixed feeds elsewhere discussed.

As remarked above, barley is grown in America chiefly for malting purposes. When the grain is moistened and kept at a certain temperature it germinates, the ferments it contains become active and convert the starch into maltose and finally into glucose, which is capable of solution in water and of alcoholic fermentation by yeast. The germinated barley is dried, freed from its sprout, which is injurious to the malted liquor, and is then known as "malt," which, either alone or together with other starchy materials whose solution it promotes, is used in the manufacture of malted liquors. A very large proportion of the protein and fat, together with some valuable carbohydrates remain in the spent malt or grains, so that these become, in turn, valuable as cattle-feeds; for this purpose they are either used in a fresh, moist state or in a kiln-dried condition.

According to Stein,† 100 parts of barley yield 92 of malt and 2.5 of sprouts, as follows:

Composition.	Barley.	Malt.	Sprouts.
Ash,	2.42	2.11	0.29
Protein,	12.28	10.98	0.77
Fiber,	19.86	18.76	0.89
Nitrogen-free extract,	61.88	58.06	0.47
Fat,	3.56	2.09	0.08
	100.00	92.00	2.50

* Bulletin 9, Chemical Division, U. S. Dept. Agric., pp. 58-78.

† Wilde's Centrbl. 1860, 2 8-23; Johnson, How Crops Grow, p. 359.

A loss of 6.5 parts occurs as the result of the life processes active during the malting.

No samples of "brewers' grains" have been submitted for examination at this time, but the following averages given by Jenkins and Winton* will suffice to give a general idea of their composition.

	Wet grains (15 analyses).			Dry grains (3 analyses).		
	Average.	Highest.	Lowest.	Average.	Highest.	Lowest.
Water,	75.7	79.4	68.6	8.2	11.9	6.2
Ash,	1.0	1.5	0.3	3.6	3.8	3.3
Protein,	5.4	6.9	4.3	19.9	20.3	19.3
Fiber,	3.8	5.6	3.1	11.0	11.6	10.2
Nitrogen-free extract,	12.5	15.9	9.6	51.7	56.8	46.1
Fat,	1.6	2.9	0.8	5.6	6.5	4.2
	100.0	.....	.....	100.0	.....	.....

Analyses of a related substance, "dried distiller's waste," made in this laboratory by C. A. Browne, Jr., and C. P. Beistle, Assistant Chemists† show that the nitrogen-free extract of the spent grains instead of being composed, as in the original malt, of starch and sugars chiefly, contains very little of these valuable nutrients, and is made up principally of pentosans of less certain feeding value.

Malt Sprouts.

Samples of malt sprouts have been received as follows:

No.	Manufacturer.	Dealer.	Price per ton.
113	(Bought in Philadelphia),	M. A. Kirby,	\$17 50
117	.....	Trenton Milling Co., Morrisville,	18 00
256	.....	Sims Co.,	13 50

Their percentage composition is:

Number.	Moisture.	Protein.	Fat.
113,	9.49	24.00	1.78
117,	10.42	21.69	1.54
256,	12.95	23.19	1.50
Range,	9.49-12.95	21.60-24.00	1.50-1.78
Average,	10.95	22.96	1.61

**Op. cit.*, p. 18.

† Journal American Chemical Society, April, 1901.

Some grains of malt were present in each case, as would be expected from the conditions of manufacture.

The composition agrees very well with Jenkins and Winton's average:

	Per cent.
Moisture,	10.2
Ash,	5.7
Protein,	23.2
Fiber,	10.7
Nitrogen-free extract,	48.5
Fat,	1.7
	<hr/>
	100.00
	<hr/>

The difference in price between Nos. 113 and 117, taken in southeastern Pennsylvania, and No. 256, taken in the northwestern corner of the State, is rather striking.

The value of this food as a low-priced balancing material is apparent.

OATS AND OAT PRODUCTS.

Owing to their composition and palatability to domestic animals, oats enter into a great variety of combinations with other grains in the preparation of a great variety of mixed feeds. Less extensively used than wheat and corn for the manufacture of breakfast foods, the various oat-meal preparations for human consumption leave, nevertheless, a large volume of residual material, chiefly oat hulls, for use in the manufacture of cattle foods. Because of the extensive use of oat hulls for this purpose, it is important to secure a clear knowledge of their composition and digestibility relative to that of the whole grain.

Considering first the proportion of hull (consisting of the pallets and sometimes the glumes) to the entire grain:

The writer, working under the direction of Mr. Clifford Richardson,* determined this proportion for 166 samples of oats sent from all sections of the United States; the average was 30.03 per cent. of the entire grain. For the compact white, black and mixed oats of the north, weighing 38 pounds per struck bushel, the proportion was 29.3 per cent.; for the fluffy, red rust-proof oats of the south, weighing 34.5 pounds per bushel, the proportion was 30.92 per cent. The extreme range in percentage of hull was 20.72 to 44.63 per cent., the grain in the latter case being evidently immature.

* Bulletin No. 9, Division of Chemistry, U. S. Department of Agriculture.

The Ohio Experiment Station from the examination of 69 varieties of oats, found a range in the percentage of hulls, of 24.6 to 35.2 per cent., average 30 per cent.

In the cleaned grain before milling the proportion of kernel is therefore 70 pounds per hundred; but, owing to the breakage of the kernel in milling, the yield of kernel is slightly reduced, being 67 pounds per hundred, on the average.

Under Richardson's directions, 179 samples of oats and 100 samples of oat hulls were analyzed, with the following percentage results:

	Kernel.	Hull.	Entire oats corresponding.
Moisture,	6.93	5.22	6.42
Ash,	2.15	5.59	3.18
Protein,	14.31	2.48	10.76
Fiber,	1.38	17.88	6.33
Nitrogen-free extract,	67.09	68.03	67.37
Fat,	8.14	.80	5.94
	100.00	100.00	100.00

While the kernels themselves are richer in protein than those of any other cereal, the adherent hull makes them, as fed, little richer than corn. However, the low digestibility of the fiber of the entire oat so reduces the proportion of digestible carbohydrates as to give to this feeding stuff a relatively high nutritive ratio. The hulls, considered alone, while they contain as much nitrogen-free extract as the kernel, really contain it less in the form of sugar and starch than in that of the less valuable pentosans, while the high fiber, low fat and low protein all tend to rank the hull with corn cob and straw in nutritive value.

The analyses reported by Richardson do not afford a convenient statement of the variations in the composition of American oats. For this, 30 analyses compiled by Jenkins and Winton may be used:

	Highest, per cent.	Lowest, per cent.	Average, per cent.
Moisture,	13.5	8.9	11.0
Ash,	2.6	2.0	3.0
Protein,	14.4	8.0	11.8
Fiber,	12.9	1.5	9.5
Nitrogen-free extract,	66.9	53.5	59.7
Fat,	5.8	3.4	5.0
	.....	.....	100.0

Despite the wide range of difference in the whole oats, the composition of the kernel is less affected by climatic conditions than is that of most other cereals, the proportion of husk to kernel being a more influential factor, and the compactness of the grain the best method of judging of its bushel value.

Ground Oats.

Only one sample of ground oats was submitted, viz: No. 123, manufactured and sold by the Weston Mill Co., of Scranton, Pa., at \$25.00 per ton. Its composition was as follows:

	Per cent.
Moisture,	8.99
Protein,	9.25
Fat,	3.90

Therefore, while much below the average in the amounts present of its more valuable components, it comes safely within the range of variation for this grain.

Oat Feeds.

From the name, it might be anticipated that these feeding stuffs would differ little from ground oats. In fact, however, they are in many cases composed chiefly of the oat hulls left as a waste from oat meal manufacture. For this reason, a careful study of their composition is important.

Samples were submitted as follows:

No.	Manufacturer.	Dealer.	Price per ton.
3	Akron Cereal Co., Akron O.,	L. A. Read, Chambersburg, Pa.,	\$16 00
102	Akron Cereal Co., Akron, O.,	W. K. Heebner, West Point, Pa.,	15 00
4	American Cereal Co., Akron, O.,	Coyle & Diehl, Chambersburg, Pa.,	17 00
5	Andrew Cullin Co., New York,	Coyle & Diehl, Chambersburg, Pa.,	16 00
183	Andrew Cullin Co., New York,	Geo. P. Wilt, Duncansville,	15 50
197	Andrew Cullin Co., New York,	Geo. P. Wilt, Duncansville,	14 00

Their analyses are as follows:

No.	Description.	Moisture.	Protein.	Fat.
3	Royal oat feed,	7.07	5.88	2.48
102	Royal oat feed,	8.27	6.19	2.50
4	Oat feed,	7.40	11.06	2.99
5	Oat feed,	7.28	7.81	3.67
183	Crescent oat feed,	7.46	6.69	3.04
197	Crescent oat feed,	7.15	6.75	3.45
	Range,	7.07-8.27	5.88-11.06	2.48-3.67
	Average,	7.44	7.40	3.02

These analyses distinctly show that, with the exception of No. 4, the feeds are largely composed of something other than the oat kernel. Assuming that the oats and hulls are of average composition, the analyses indicate that, with the exception named, the feeds contain at least one-half their weight of added oat hulls.

The condition of the hulls in the different samples is quite different, being coarse in some cases, fine in others. The Royal Oat Feed samples contain 38 to 48 per cent. of coarse hull, while the amount in Nos. 4 and 5 was less than 3 per cent.

No guaranties accompanied the lots from which these samples were drawn. In New York State, the Crescent Oat Feed is licensed with a guaranty of 11.0 per cent. of protein and 7.35 per cent. of fat, but a sample reported in September, 1900 (Bulletin No. 176, pp. 28-9, New York Exp. Station), showed only 7.8 per cent. protein and 3.5 per cent. fat, while three samples analyzed in New England between May, 1898, and January 1, 1900, contained an average of 7.9 protein and 3.3 per cent. fat. The quality of the goods sold in Pennsylvania not only falls below that guaranteed in New York, but also is materially inferior to that exhibited by the samples analyzed in New York and New England.

The Royal Oat Feed was guaranteed in New York State to have 8.25 per cent. protein and 4.14 per cent. fat; but a single analysis made there in 1900, showed only 5.1 per cent. protein and 2.5 per cent. fat.

While the variations in composition to which both the entire oat and the oat hulls are subject, make impossible any exact computation of the precise proportion in which they are combined to form a given mixture from its composition, the following statements based upon the average composition of the respective ingredients may be helpful:

	Protein, per cent.	Fat, per cent.
Equal parts of oats and oat hulls,	6.63	3.40
One-third oats, two-thirds hulls,	4.92	2.53

In this connection should be mentioned two feeds which are sold under names that are not descriptive:

No.	Manufacturer.	Dealer.	Price per ton.
91	Muscatine Oat Meal Co., Muscatine, Iowa,	J. Watson Craft, Ambler, Pa.,	\$16 00
263	American Cereal Co., Chicago, Ill.,	J. B. Deckard, Middletown, Pa.,	16 00

Their analyses are (per cent.):

No.	Description.	Moisture.	Protein.	Fat.
91	Friends' consolidated dairy food,	8.58	6.31	3.08
263	Cereal feed,	7.23	4.06	1.55

The analyses immediately reveal the inferior character of these feeds.

Microscopic examination shows these two feeds to be chiefly composed of oat hulls, hair and dust, with more of the dust in the former of the two foods.

In general, the nutritive value of such feeds is little greater than that of corn stover. The term "concentrated foods" is not properly applied to them.

CORN.

From the fact that corn is the leading grain grown for cattle feeding and that, more than any other cereal, it is subjected to a great variety of manufacturing processes for the production of starch, glucose and a great variety of other articles of human consumption, especial interest attaches to its composition.

The percentage composition of the two great groups of varieties, the dent and the flint, is well represented by the figures for American analyses compiled by Jenkins and Winton.*

Percentage Composition of Corn.

	Dent (86 analyses).			Flint (68 analyses).		
	Average.	Highest.	Lowest.	Average.	Highest.	Lowest.
Moisture,	10.6	19.4	6.2	11.3	19.6	4.5
Ash,	1.5	2.6	1.0	1.4	1.9	1.0
Protein,	10.2	12.8	7.5	10.5	13.7	7.0
Crude fiber,	2.2	4.8	0.9	1.7	2.9	0.7
Nitrogen-free extract,	70.4	75.7	65.4	70.1	76.7	65.0
Fat,	5.0	7.5	3.1	5.0	7.1	3.4
	100.0	.....	.....	100.0	.....	.....

There is therefore little difference in the general composition of these two types of corn, notwithstanding their unlike appearance in form and usually in color. The greatest difference observed is in

*Bulletin 11, Office of Experiment Station, U. S. Dept. of Agriculture.

the smaller amount of fiber in the flint corn and in its wider range of composition as respects protein and nitrogen-free extract, and less range in fiber and ash.

Considering the range of variation, it is apparent that while the highest figure for nitrogen-free extract is but one-sixth greater than the lowest, the highest percentages of protein and fat are about twice as great as the lowest percentages; in the less important constituents, fiber and ash, the range of variation is even greater.

The kernel of the corn exhibits a subdivision into parts distinctly seen by the naked eye. Voorhees* has studied the composition of these several parts, which he describes somewhat as follows:

"a. The husk or skin, which covers the whole kernel; it consists of two distinct layers, the outer and inner, which when removed constitute the bran, and contain practically all the crude fiber of the whole grain.

b. "A layer of gluten cells, which lies immediately underneath the husk; it is yellow in color, and cannot be readily separated from the remainder of the kernel.

"c. The germ, readily distinguishable by its position and form; it also contains gluten, though it is particularly rich in oil and mineral constituents.

"d. The starchy portion of the grain, which is divisible into two sub-portions—a yellow, flinty part lying on the sides of the grain and made up of very compact cells and a lighter colored portion in which the cells are less compact; in both portions, however, starch is the principal material in the cells.

A somewhat imperfect separation of 100 kernels of new corn into skin, germ and endosperm (starchy and hard part) showed their proportion by weight and their percentage composition to be as follows:

Composition of Different Parts of Maize Kernel (per cent.).

	Original kernel.	Skin.	Germ.	Endosperm.
Proportion in 100 parts of the kernel,	100.00	5.56	10.17	84.27
Composition:				
Water,	24.74	15.29	29.62	24.66
Water-free substance,	75.26	84.71	70.38	75.34
Composition of water-free substance:				
Ash,	1.73	1.27	11.13	0.68
Protein,	12.65	6.60	21.71	12.23
Fiber,	2.02	16.45	2.88	0.65
Nitrogen-free extract (chiefly starch),	79.26	74.09	34.66	84.90
Fat,	4.24	1.59	29.62	1.54

* 15th Ann. Rep., N. J., Agr. Exp. Station, p. 183.

On the basis of these figures, the distribution of materials of the constituents in 100 pounds of the new corn is as follows:

Distribution of Constituents of Maize Kernel Among Its Parts.

	In entire grain, lbs.*	In skin, lbs.	In germ, lbs.	In endosperm, lbs.
Water,	24.64	.85	3.01	20.78
Dry matter,	75.36	4.71	7.16	63.49
Components of dry matter:				
Ash,	1.29	.06	.80	.43
Protein,	9.62	.31	1.55	7.76
Fiber,	1.39	.77	.21	.41
Nitrogen-free extract,	59.87	3.50	2.48	53.91
Fat,	3.17	.07	2.12	.98

* Computed by adding the results for the three portions of the grain.

These figures show that despite the imperfect separation of the skin, it contains over half of the entire fiber of the kernel, and very little of the protein, fat and ash. The germ, on the other hand, though it constitutes only one-tenth of the kernel, contains two-thirds of the fat and ash, and nearly one-sixth of the protein. The endosperm, forming nearly seven-eighths of the entire kernel, contains about four-fifths of the protein, one-third of the ash, fiber and fat, and nine-tenths of the starch and related matters.

The consequences of these differences in composition of the several parts of the kernel are seen in the make-up of the numerous by-products of corn that are left when a portion of the kernel is abstracted for the manufacture of starch, glucose or some of the numerous breakfast foods that are made from corn.

Shelled Corn.

Among the samples submitted for examination were the following lots of shelled corn:

No.	Manufacturer.	Price per ton.
161	Clapper Bros., Martinsburg, Pa.,	\$21 00
186	R. Lee Walker, Duncansville, Pa.,	16 79

Their percentage composition was as follows:

Number.	Moisture.	Protein.	Fat.
161,	10.14	9.19	4.48
186,	10.76	9.13	4.14

These percentages are well within the range for dent corn, though not up to the average.

Cracked Corn.

A sample sold under the name "Fine Cracked Corn for Young Chicks," selling at \$19.00 per ton, was taken from the manufacturers, Snyder Bros., Dalton, Pa. Its composition is as follows:

Number.	Moisture.	Protein.	Fat.
143,	9.95	9.00	2.47

The proportion of fat is lower than any recorded in Jenkins and Winton's tables of American analyses.

Corn Chop and Meal.

A considerable series of samples have been examined representing both the coarser "chops" and the more finely ground "meal" sold in the State. Among the samples labeled as "corn chop" are a number, manufactured by the Pittsburg Milling Co., that, from their large proportion of fat, are classed more properly as "hominy chops." Their analyses are therefore presented with those of the latter class of materials.

The sources of the several samples are as follows:

Corn Chop.

No.	Manufacturer.	Dealer.	Price per ton.
175	Bare Milling Co., Rearing Spring, Pa.,	Bare Milling Co., .....	.....
274	Levi Brant, Harrisburg, Pa.,	Levi Brant,	\$20 00
200	Central Elevator Co., Pittsburg, Pa.,	McClelland & Siple,	22 00
232	Central Elevator Co., Pittsburg, Pa.,	C. Beckert,	18 50
188	Clapper Bros., Martinsburg, Pa.,	Clapper Bros.,	20 00
41	H. F. Dry, Oley, Pa.,	A. N. Kissinger & Son., Reading, Pa.,	25 00
62	H. H. Gring, Mohnsville, Pa.,	H. H. Gring,	21 00
57	David Hartz, Morgantown, Pa.,	David Hartz,	19 00
158	H. W. Lechrone, Duncansville, Pa.,	H. W. Lechrone,	19 00
189	C. E. Lingafelt, Hollidaysburg, Pa.,	C. E. Lingafelt,	19 00
206	R. S. McCague & Co., Pittsburg, Pa.,	W. W. Cleland,	20 00
19	McDermott, Wertz & Co., Johnstown, Pa.,	Gustave Bostert, Johnstown, Pa.,	19 00
173	F. & I. Mentzer, Frankstown, Pa.,	F. & I. Mentzer,	22 00
210	Pittsburg Milling Co., Pittsburg, Pa.,	C. Kelner, Allegheny, Pa.,	20 00
157	R. Lee Walker, Duncansville, Pa.,	R. Lee Walker,	19 00
172	G. P. Wilt, Blair's Gap Mills, Duncansville, Pa.	G. P. Wilt,	19 00

Corn Meal.

No.	Manufacturer.	Dealer.	Price per ton.
207	Altman Mills, Toledo, O.,	Peter Bock, Pittsburg,	\$21 00
245	D. H. Beebe, Corry, Pa.,	D. H. Beebe,	19 00
67	Eclipse Milling Co., Brownsville, Pa.,	Eclipse Milling Co.,	10 00
70	Gaddis & Co., Uniontown, Pa.,	M. H. Clarke, Uniontown, Pa.,	20 00
169	H. Mulhollen,	H. Mulhollen, .....	.....
205	Pittsburg Milling Co., Pittsburg, Pa.,	M. E. Coleman, East End, Pittsburg, Pa.,	20 00
231	Pittsburg Milling Co., Pittsburg, Pa.,	Chas. Friel, Pittsburg, Pa.,	22 00
150	C. H. Sears, Clark's Summit, Pa.,	C. H. Sears,	19 00
47	Geo. S. Snyder, Hatfield, Pa.,	A. N. Kissinger & Son, Reading, Pa.,	26 00
139	Snyder Bros., Dalton, Pa.,	Snyder Bros.,	19 00
208	Toledo Grain & Milling Co., Toledo, O., ..	M. E. Coleman, Pittsburg, Pa.,	21 00
28	C. W. Walter, Walters, Pa.,	C. W. Walter,	18 00
77	Warner Bros., Grant Station, N. Y.,	Warner Bros.,	21 00
82	Warren Mills, Warren, Pa.,	Warren Mills,	19 00
129	Weston Mill Co., Scranton, Pa.,	Weston Mill Co.,	19 00

Percentage Composition of Corn Chops and Meals.

No.	Description.	Moisture.	Protein.	Fat.
<i>Corn Chop.</i>				
175	Pure corn chop,	10.70	9.19	3.97
274	Corn chop,	11.11	9.31	3.92
200	Corn chop (coarse meal),	9.99	9.44	4.35
232	Corn meal "chop",	9.90	9.63	3.78
188	Pure corn chop,	10.00	7.50	4.27
41	Clear corn chop,	11.20	9.13	4.39
62	Pure corn chop,	10.98	8.44	3.98
57	Pure corn chop,	11.23	8.31	4.92
158	Pure corn chop,	10.29	9.06	3.89
189	Corn chop,	10.18	9.50	4.00
206	Corn meal "chop",	10.69	8.81	3.73
19	Corn chop,	11.50	9.56	3.98
173	Pure corn chop,	10.23	9.13	4.24
210	Yellow corn "meal chop",	10.50	8.88	3.41
157	Corn chop,	10.23	9.69	4.18
172	Corn chop,	10.52	9.44	4.18
	Range,	9.90-11.50	7.50-9.69	3.41-4.39
	Average,	10.58	9.06	4.03
<i>Corn Meal.</i>				
207	Corn meal,	10.04	8.00	3.85
245	Corn meal,	10.00	8.31	3.89
67	Corn meal,	10.73	8.81	3.58
70	Corn meal,	11.43	7.94	3.05
169	Corn meal (not descriptively named),	10.81	9.31	4.26
205*	Corn meal, white,	7.77	10.75	8.39
231	Corn meal,	9.12	10.13	5.04
150	Corn meal,	10.39	9.00	4.09
47†	Granulated corn meal,	11.75	8.38	.97
139	Corn meal,	9.90	9.38	4.05
208	Corn meal, yellow,	9.77	7.75	3.18
28	Corn meal,	11.40	8.56	3.99
77	Corn meal,	12.15	8.69	3.82
82	Corn meal,	12.14	9.31	3.76
129	Corn meal,	9.81	9.13	3.95
	Range, omitting Nos. 47 and 205,	9.12-12.15	7.75-10.13	3.05-5.04
	Average, omitting Nos. 47 and 205,	10.59	8.87	4.66

* Evidently a hominy meal.

† Oil deficient.

Excluding Nos. 205 and 47 as special products, evidently not produced by a simple milling process, we may compare the composition found for the Pennsylvania samples, with those obtained elsewhere:

Composition of Corn Crop in Different States. (per cent.)

	Number of analyses.	Protein.			Fat.		
		Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
Pennsylvania samples:							
Chop,	15	9.69	7.50	9.06	4.29	3.41	4.03
Meal,	12	10.13	7.75	8.83	5.04	3.05	4.19
United States:							
Analysis completed by Jenkins and Winton (1892)—							
Meal,	77	13.9	7.1	9.2	5.1	2.0	3.8
New England States (1898-9),....	17	10.8	8.6	9.5	4.7	2.7	4.0

All samples fall within the established limits of variation. There is a general tendency for the corn meals to run low in protein.

No. 205 belongs rather to the class of "hominy chops," as its high percentage of fat indicates.

A microscopic examination shows:

No. 157. Contains some portions of cob, but possibly no more than might be due to careless cleaning after shelling.

No. 172. Contains cob, like No. 157, and also contains a small, but considerable proportion of oat hulls. Oat kernels were not found.

No. 231. Contains a few whole oats, evidently an accidental mixture.

Corn-and-Cob Chops.

The chopping of the cob with the kernel results in the production of a very different food, because of the highly different composition of the cob as well as because of its bulkiness. Eighteen American analyses of the cob compiled by Jenkins and Winton, exhibit the following percentages:

	Mean.	Highest.	Lowest.
Moisture,	10.7	24.8	7.2
Ash,	1.4	2.7	0.7
Protein,	2.4	3.7	1.2
Fiber,	30.1	38.3	18.2
Nitrogen-free extract,	54.9	66.7	43.8
Fat,	0.5	0.9	0.1
	100.00	.....	.....

Not only is the protein barely one-fourth as abundant as in the kernel and the fat but one-tenth as much, but the fiber is fourteen times as great in amount; moreover, the nitrogen-free extract of the cob, instead of being composed, like that of the grain, chiefly of starch, is largely made up of less valuable pentosans.

The proportion of cob to kernel in well developed dent corn varies little from 14 pounds in 70 pounds of ears, or one part of cob to four of shelled corn.

Figuring on this proportion and upon the basis of the average composition of dent kernel and of cob given above, the mean composition of corn-and-cob meal should be:

	Per cent.
Moisture,	10.6
Ash,	1.5
Protein,	8.7
Fiber,	7.8
Nitrogen-free extract,	67.3
Fat,	4.1
	<hr/>
	100.00
	<hr/>

Six samples of this material were submitted for analysis, taken from the following sources:

No.	Manufacturer.	Dealer.	Price per ton.
53	M. C. Dietrich, Kempton, Pa.,	M. C. Dietrich,	\$14 50
185	H. W. Lechrone, Duncansville, Pa.,	H. W. Lechrone,	16 00
191	C. E. Lingafelt, Hollidaysburg, Pa.,	C. E. Lingafelt,	17 00
151	F. & I. Mentzer, Frankstown, Pa.,	F. & I. Mentzer,	17 00
64	John H. Schmehl, Scarlett's Mills,	John H. Schmehl,	18 00
35	C. W. Walter, Walter's, Pa.,	C. W. Walter,	15 00

Percentage Composition of Corn-and-Cob Chops.

No	Description.	Moisture.	Protein.	Fat.
53	Corn-and-cob chop,	10.77	7.56	3.52
185	Ear corn chop,	10.06	7.81	3.44
191	Corn-cob and all,	10.39	7.81	3.48
151	Two-thirds ear, one-third shelled corn chop,	10.62	8.50	3.31
64	Corn-cob chop,	11.15	6.88	3.31
35	Cob feed,	11.44	6.94	3.45
	Range,	10.06-11.44	6.88-8.50	3.31-3.52
	Average,	10.74	7.58	3.42
	Average, omitting No. 151,	10.76	7.40	3.44

New England Control reports do not discuss this feeding-stuff. Jenkins and Winton compiled the results of seven analyses made prior to 1892. They compare with the foregoing, omitting No. 151, as follows:

	Number of samples.	Protein, Per cent.			Fat, Per cent.		
		Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
Pennsylvania,	5	7.81	6.88	7.40	2.52	3.31	3.44
United States,	7	12.2	5.8	8.5	4.7	2.5	3.5

These analyses are therefore about normal, though, as in case of the corn meal, the tendency is toward a low protein average.

No. 151 is found, upon examination, to contain a large proportion of oat hulls, which, selling under the name given to this sample, constitutes a serious adulteration notwithstanding the fact that the material contains more protein than the other corn-and-cob meals.

Gluten, Gluten Meal and Gluten Feed.

These are by-products from the manufacture of starch and glucose from corn.*

The process is essentially as follows: The corn is soaked for some hours in a weak solution of sulfurous acid. In the resulting softened condition it is ground, the ground products being carried off in the water. The germ or chit floats on the surface and is gathered by skimming. The starch and gluten are carried off in the water and deposit separately because the starch is heavier, the hull having been previously separated by passing the water through sieves. The starch thus separated is the main product. The other materials are deprived of most of their moisture by pressure and then kiln-dried.

The gluten meal is sometimes sold by itself; often in combination with the husk or bran, and sometimes the "chit" or germ, as "gluten feed." The composition of these by-products is subject to a further variation from the fact that, in some factories, the corn oil is partially removed. When the germ is kept apart, it is frequently deprived of a large fraction of its oil by hydraulic pressure; the press-

* The so-called "Atlantic gluten meal" is an exception, being derived instead as a by-product of the manufacture of wheat-starch. It contains 48.9 per cent. of protein and 7.9 per cent. of fat.

cake is then sold as germ oil cake. The bran also is often sold as a separate food-stuff.

Owing to the large amounts of water used in these separations, the several products are exhausted of a large portion of their soluble mineral water, chiefly phosphate of potassium.

No samples of genuine "gluten meal,"* were submitted, though several samples of gluten feed were received under the label "gluten meal." The samples of gluten feed received were:

No.	Manufacturer.	Dealer.	Price per ton.
149	American Glucose Co., Chicago,	Snyder Bros., Dalton, Pa.,	\$18 50
116	Buffalo Sugar Refining Co., Buffalo, N. Y.,	M. A. Kirby,	16 00
240	Buffalo Sugar Refining Co., Buffalo, N. Y.,	R. S. McCague, Pittsburg, Pa.,	18 00
31	Glucose Sugar Refining Co., Peoria, Ill.,	C. W. Walter, Walters, Pa.,	18 00
43	Glucose Sugar Refining Co., Chicago, Ill.,	A. N. Kissinger & Son, Reading, Pa.,	20 00
282	Glucose Sugar Refining Co., Chicago, Ill.,	John B. Curry, Swatara Sta., Pa.,	18 50
107	Glucose Sugar Refining Co., Chicago, Ill.,	Morris Briggs, Woodbourne, Pa.,	19 00
55	Glucose Sugar Refining Co., Rockford, Ill.,	Mahlon C. Dietrich,	18 00
81	.....	Warren Mills Co., Warren, Pa.,	18 00
118	.....	Trenton Milling Co., Morrisville, Pa.,	20 00
137	.....	C. H. Sears, Clark's Summit,	19 00
243	.....	Crouch Bros., Erie, Pa.,	17 00

Percentage Composition of Gluten Feeds.

No.	Description.	Moisture.	Protein.	Fat.
149	Gluten feed,	8.67	24.31	3.44
116	Coarse gluten,	7.86	13.88	3.04
240	Gluten feed,	8.55	25.75	2.43
31	Gluten feed,	9.11	25.19	3.16
43	Gluten feed,	9.84	26.56	2.19
282	Buffalo gluten feed,	8.46	26.75	2.53
107	Gluten,	8.08	26.50	2.41
55	Gluten feed,	9 15	24.00	3.53
81	Gluten feed,	9.08	27.00	2.76
118	Gluten,	8.48	25.19	3.55
137	Gluten feed,	9.14	25.94	2.68
243	Gluten feed,	8.19	25.75	2.38
	Range,	7.86-9.84	13.88-27.00	2.19-3.55
	Average,	9.72	24.72	2.84

The average composition of gluten meal derived from corn is stated by Jenkins and Winton as:

	Per cent.
Water,	9.6
Ash,	0.7
Protein,	29.4
Fiber,	1.6
Nitrogen-free extract,	52.4
Fat,	6.3
	<hr/>
	100.0

* Later analyses show an average of 36.7 per cent. protein and 2.7 per cent. fat for Chicago gluten meal, and 34.1 per cent. protein and 3.2 per cent. fat for "cream gluten."

There was no microscopic evidence of adulteration of these materials.

It is interesting to note that "gluten meal" is not included among the samples secured and that "gluten feed" is in quite a number of cases described by the generic name "gluten." Yet among the samples recently analyzed by the New England States, there were 118 gluten meals and 79 gluten feeds.

On considering the composition of No. 116, it is clear that the name "coarse gluten" is a misbrand. The material corresponds better to "fancy corn bran" which is sold by the Glucose Sugar Refining Company in New York State under a guaranty of 13.5 per cent. protein and 3 per cent. fat.

There are a number of brands of gluten feed upon the market. The general tendency of business consolidation has been toward a greater uniformity in production, certainly toward a diminution in the number of brand names for the same general product.

Since the names secured by the sampling agents do not clearly indicate the brand names of these goods, our comparisons will be confined to the gluten feeds whose manufacturers are named, practically all coming from the Glucose Sugar Refining Company's factories.

Comparative Composition of Gluten Feeds in Different States.

	Number of analyses.	Protein, Per cent.			Fat, Per cent.		
		Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
Pennsylvania:							
All analyses (except 116),	11	27.00	24.00	25.71	3.55	2.19	2.64
Glucose Sugar Refining Company's brands,	7	26.75	24.00	25.58	3.53	2.19	2.81
New England, 1898-99:							
Buffalo gluten feed,	34	29.6	25.3	27.5	4.7	2.3	3.1
Diamond gluten feed,	30	30.1	20.3	23.6	4.0	2.0	3.0
New York, 1899:							
Buffalo gluten feed,	6	27.63	21.31	26.10	4.67	3.38	3.71
Diamond gluten feed,	2	20.56	20.00	20.28	5.21	3.40	4.30
All analyses, 1900,	21	.....	.....	23.75	.....	.....	4.55
Buffalo gluten feed, 1900,	3	27.0	24.1	25.9	5.0	2.9	3.9
Diamond gluten feed, 1900, ..	3	25.9	24.4	25.3	3.6	2.8	3.2

The composition guaranteed in New York for the year 1900 for the Buffalo, Diamond, Davenport and Marshalton brands was protein 27 per cent., fat 3.3 per cent.

The gluten feed sold in Pennsylvania seems to be chiefly of the Buffalo brand. Judging from the results of analysis in neighboring

States having food controls, the goods sold in Pennsylvania is somewhat inferior, on the average, to those sold where the law requires a guaranty of composition and provides the means for chemical examination of the foods.

Germ Oil Cake.

A single sample of "germ oil cake," manufactured by the Glucose Sugar Refining Co., of Chicago, and purchased from W. K. Heebner, West Point, Pa., at \$22.50 per ton, shows the following percentage composition:

	Per cent.
Moisture,	9.67
Protein,	22.56
Fat,	9.77

By the removal of three-fourths of its moisture and of two-thirds of its fat by drying and pressing, a germ having the original composition shown in Voorhees's analysis, would yield a cake containing 11.71 per cent. moisture, 23.94 per cent. protein and 10.99 per cent. fat, quantities a little higher than those shown in the market sample; but the corn examined by Voorhees was exceptionally rich in protein.

Under the name "germ oil meal" the Glucose Sugar Refining Company offers a feeding stuff guaranteed to contain 25 per cent. protein and 10.5 per cent. fat. The foregoing sample falls considerably under this guarantee in both constituents.

Corn Bran.

Three samples of this material were submitted:

No.	Manufacturer.	Dealer.	Price per ton.
101	Marfield & Co., Chillicothe, O.,	W. K. Heebner, West Point, Pa.,	\$16 60
98	—, Nashville, Tenn.,	W. K. Heebner, West Point, Pa.,	18 00
88	—, Nashville, Tenn.,	Simpson Bros., Norristown, Pa.,	18 00

The percentage composition of these samples was as follows:

No.	Description.	Moisture.	Protein.	Fat.
101	White corn bran, fine,	11.42	9.44	6.88
98	White corn bran, coarse,	8.85	11.50	12.07
88	White corn bran,	9.78	11.31	12.17
	Range,	8.85-11.42	9.44-11.50	6.88-12.17
	Average,	10.00	10.75	10.37

There are few data available for comparison with these analyses. The following may suffice:

	Number of analyses.	Protein, Per cent.			Fat, Per cent.		
		Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
New Jersey, 1894,	3	11.83	10.16	10.97	8.22	3.75	6.64
New York, 1900,	1	11.9	9.2	10.05	7.9	4.3	6.1
Pennsylvania,	3	11.50	9.44	10.75	12.17	6.88	10.27

The Pennsylvania samples are marked by the possession, in two cases out of three, of an exceptionally high proportion of corn-oil. In all these cases, the fat or oil, and the protein also, so far exceeds that found by Voorhees in the true skin or bran, that it is clear a very considerable proportion of the germ must remain with the true bran in the goods marketed under the latter name.

Sugar Feed.

A single sample of this name, No. 90, described as manufactured in Chicago, Ill., and sold by Simpson Bros., of Norristown, Pa., at \$16 per ton, was received, with the accompanying statement that dairymen feeding it, believe it is giving good results.

The analysis is as follows:

	Per cent.
Moisture,	9.76
Protein,	7.94
Fat,	7.40
Reducing sugar, calculated as dextrose, ....	.90

Optical examination shows this to be a coarse corn-bran, from white corn, with no considerable quantity of finely divided material; the microscope shows no foreign starches present. The food is, as both the analysis and optical examinations show, corn bran.

Sugar Corn Feed.

A single sample of this product was submitted, described as manufactured by The Glucose Sugar Refining Co., Chicago, Ill., and sold by The Sims Co., Erie, Pa., at \$14.00 per ton. A guaranty of 10.07 per cent. protein and 3.90 per cent. fat, accompanied the sample.

The analysis gave the following figures:

	Per cent.
Moisture,	8.41
Protein,	12.81
Fat,	2.72

A sample sold under this brand name, made by the same company, and guaranteed to contain 13.5 per cent. protein and 3 per cent. fat, was analyzed by the New York Experiment Station (Bulletin 176, p. 29) with the following results:

	Per cent.
Protein,	11.8
Fat,	5.8

Other samples of feeding stuffs sold under this name, but concerning whose manufacturer no information is given, have been analyzed recently as follows:

Moisture.	Protein.	Fat.	Laboratory.
.....	12.3	5.2	N. Y. Station, B. 176, p. 29.
.....	8.6	7.9	N. Y. Station, B. 176, p. 29.
9.96	11.25	5.12	N. Y. Station, B. 166, p. 264.*
.....	10.00	4.57	R. I. Sta., B. 63, p. 100.

*This sample contained 11.91 per cent of crude fiber.

Comparison of these analyses with that of corn bran show a quite close resemblance between this feeding-stuff and the bran in their richness in protein and fiber, though the fat is considerably more abundant on the average in the bran. Furthermore, the feed does not seem to be very uniform in composition, quite marked variations from guaranty being observed in both instances where a guaranty was given.

Hominy Chop.

Under this name and the terms "white meal," "hominy feed" and "Baltimore meal," is sold a by-product from the manufacture of hominy. In making the hominy, the hard, inner portion of the grain is removed, while the hull, germ and portions of the starchy part of the kernel are combined to form the cattle food.

Two samples were submitted:

No	Manufacturer.	Dealer.	Price per ton.
145	Weston Mill Co., Scranton, Pa.,	Weston Mill Co.,	\$20 00
250	.....	Crouch Bros., Erie, Pa., ..	17 00

Analysis (per cent.)

No.	Description.	Moisture.	Protein.	Fat.
145	Hominy chop,	8.44	11.25	9.78
250	Hominy,	8.99	10.25	7.40

The Connecticut Station (B. 130, p. 33), gives a summary of eight complete analyses of these materials:

	Per cent.
Moisture,	8.43
Ash,	2.60
Protein,	11.35
Fiber,	4.92
Nitrogen-free extract,	64.64
Fat,	8.06

So that, having about six or seven per cent. less fiber than corn bran and about five per cent. more starchy matter, the hominy chops more nearly resemble entire corn meal in composition; practically it differs from the corn itself only in having a few per cent. less starch and relatively more of the other valuable components.

From their composition it is evident that a number of samples whose brand name indicates that they may be simply ordinary corn chop, belong rather among the hominy chops. They are the following:

No.	Manufacturer.	Dealer.	Price per ton.
204	Pittsburg Milling Co., Pittsburg, Pa.,	Brown & Co., Pittsburg, Pa.,	\$20 00
202	Pittsburg Milling Co., Pittsburg, Pa.,	Wm. Fisher, Pittsburg, Pa.,	18 00
224	Pittsburg Milling Co., Pittsburg, Pa.,	D. Whitmyer, Allegheny, Pa.,	18 00
225	Pittsburg Milling Co., Pittsburg, Pa.,	C. Kelner, Allegheny, Pa.,	19 00
219	Pittsburg Milling Co., Pittsburg, Pa.,	Wm. Fisher, Pittsburg, Pa.,	20 00
238	Pittsburg Milling Co., Pittsburg, Pa.,	D. Whitmyer, Allegheny, Pa.,	19 00

Their percentage composition is as follows:

No.	Description.	Moisture.	Protein.	Fat.
204	Corn chop,	7.96	11.19	9.23
202	White corn chop,	8.65	11.00	9.21
224	White corn chop,	8.19	10.75	8.93
225	White corn meal chop,	8.35	11.19	8.97
219	Yellow corn chop,	9.00	10.69	8.54
238	Yellow corn chop,	8.32	11.50	9.32

The differences in selling price of these goods are not strictly in accordance with their composition.

Microscopic examination of these samples gives the following results:

No. 224. Is coarse ground; contains, in addition to coarse particles of the corn bran, occasional bits of oat hull and quite a little corn cob, though possibly not more than would result from imperfect cleaning of the kernel during the process of shelling.

No. 219. Contains a very noticeable quantity of oat hulls.

No. 238. Like No. 219, is evidently made by blending several materials. Considerable oat hull and more corn cob than a good clean article of corn should yield, are present. The major portion of the corn bran and grain is white, but numerous small yellow particles, either of the pure endosperm, or of its more highly nitrogenous portion, of yellow corn is present.

In composition, at least as regards their richness in protein and fat, these samples do not differ conspicuously from the others of the same group.

Cerealine Feeds.

These are by-products from the manufacture of "cerealine" breakfast foods and are made from white corn exclusively.

The samples submitted are:

No.	Manufacturer.	Dealer.	Price per ton.
99	Cerealine Manufacturing Co., Indianapolis, Ind.	W. K. Heebner, West Point, Pa.,	\$17 00
135	Cerealine Manufacturing Co., Indianapolis, Ind.	C. H. Sears, Clark's Summit, Pa.,	19 00
94	Cerealine Manufacturing Co., Indianapolis, Ind.	W. K. Heebner,	18 00

The percentage composition of the samples is:

No.	Description.	Moisture.	Protein.	Fat.
99	Cerealine Feed, No. 1,	8.49	11.75	9.75
135	Cerealine Feed, No. 1,	8.99	9.94	7.62
94	Cerealine Feed, No. 2 (?),	9.95	25.88	2.69

The composition of Feed No. 1 is similar to that of hominy chop; that of the sample purporting to represent Feed No. 2, resembles gluten feed. No guaranties accompany the descriptions of these feeds, but the guaranties given in New York State during the year 1900 are as follows:

	Protein, per cent.	Fat, per cent.
Cerealine Feed, No. 1,	9.00	5.82
Cerealine Feed, No. 2,	10.31	8.62

A single sample of No. 2 analyzed by the New York Station is in harmony with the guaranty. It seems practically certain therefore that the description of Sample No. 94 is erroneous.

Microscopic examination shows nothing noteworthy.

BUCKWHEAT AND ITS BY-PRODUCTS.

Buckwheat is the source of a number of by-products of the widest difference in feeding value. The grain is composed of a thick, dark brown hull, made up of four layers of different tissue; the grain proper is covered by a thin branny coating, under which lies a layer of aleurone cells, rich in protein like those of the common cereals, and finally, lying within this layer, is found the endosperm from which the flour is made. The milling products, properly classified, are as follows:

1. The flour, including the endosperm with as little as possible of the other layers.
2. The middlings, composed in part of the endosperm and aleurone, layer, and containing a portion of the true seed coat.
3. The bran, composed chiefly of the true seed coat, with small portions of the aleurone layer and endosperm.
4. The hulls.
5. Buckwheat feed composed of hulls and bran or middlings, often with a portion of the hard outer layer of the hull removed.

The general percentage composition of the several principal parts of the grain, as separated by milling, is as follows:

	Flour.	Middlings.	Bran.	Hulls.
Moisture,	14.6	13.2	9.2	8.0
Ash,	1.0	4.8	5.0	2.5
Protein,	6.9	28.9	30.4	5.8
Fiber,	0.3	4.1	4.9	37.7
Nitrogen-free extract,	75.8	41.9	41.9	44.4
Fat,	1.4	7.1	8.6	1.6

That is to say, there is very little difference between the bran and middlings in practice. The hulls are woody and of low digestibility; they possess little feeding value.

Two samples of buckwheat were received for analysis:

No.	Manufacturer.	Dealer.	Price per ton.
128	Snyder Bros., Dalton, Pa.,	Snyder Bros.,	\$40 00
141	Snyder Bros., Dalton, Pa.,	Snyder Bros.,	18 00

Their description and composition are as follows:

No.	Description.	Moisture	Protein.	Fat.	Remarks.
128	Buckwheat flour,.....	11.59	5.88	1.06	Microscopically pure.
140	Buckwheat middlings,.	10.00	31.06	8.77	Contains considerable proportion of hulls.

The flour, No. 128, is exceptionally free from particles of the exterior layers of the grain and is absolutely without foreign admixture. The "middlings" is, properly speaking, "buckwheat feed." Its composition is up to that of average buckwheat middlings, but it contains a considerable proportion of hulls which cannot, by any stretch of courtesy, be allowed sale under the name "bran" or "middlings." This is a case of adulteration with very little of fraud if the goods be sold after examination, because the least experienced buyer, if he were acquainted with the proper meaning of the term middlings, could not fail to note the presence of the coarse hulls.

MIXED FEEDS.

Corn and Oat Feeds.

Properly, these feeding-stuffs should be composed of a mixture of ground corn and ground oats, but very frequently large proportions of the relatively valueless hulls are admixed.

The average percentages of fat in corn and oats are the same, and those of protein are so nearly the same that there is only one-half per cent. more protein in a corn-and-oats chop containing two parts of oats to one of corn, than in a chop made from one part of oats to two of corn. A chop made from equal parts of oats and corn, such as is called "provender" in New England, should contain about 11.1 per cent. of protein and 5.0 per cent. of fat.

The following samples were received:

No.	Manufacturer.	Dealer.	Price per ton.
97	American Cereal Co., Akron, O.,	W. K. Heebner, West Point, Pa.,	\$18 00
280	American Cereal Co., Chicago, Ill.,	John B. Curry, Swatara Station, Pa.,	18 00
283	American Cereal Co., Chicago, Ill.,	Cyrus Romberger, Lykens, Pa.,	18 00
252	D. H. Beebe, Corry, Pa.,	D. H. Beebe, Corry, Pa.,	19 00
235	The Central Elevator Co., Pittsburg, Pa.,	L. W. Kartlick, 22 Penn Ave., Pittsburg, Pa.,	18 00
156	Clapper Bros., Martinsburg, Pa.,	Clapper Bros.,	20 00
247	Densmore Bros., Erie, Pa.,	Densmore Bros.,	18 00
42	H. F. Dry, Oley, Pa.,	A. N. Kissinger & Son, Reading, Pa.,	21 00
78	D. H. Grandin, Jamestown, N. Y.,	D. H. Grandin,	23 00
59	David Hartz, Morgantown, Pa.,	David Hartz,	20 00
258	F. L. Heath, Corry, Pa.,	F. L. Heath,	19 00
50	James Heffner, Kutztown, Pa.,	Chas. W. Pennock, Reading, Pa.,	18 00
177	C. E. Lingafelt, Hollidaysburg, Pa.,	C. E. Lingafelt,	19 00
13	McDermott, Wertz & Co., Johnstown, Pa.,	McDermott, Wertz & Co.,	20 00
16	McDermott, Wertz & Co., Johnstown, Pa.,	Gustav Bostert, Johnstown, Pa.,	19 00
23	Toledo Grain and Milling Co., Toledo, O., ..	Pennsylvania Traffic Co., Ltd., Johnstown, Pa.,	21 00
214	Toledo Grain and Milling Co., Toledo, O., ..	M. E. Coleman, 6114 Centre Avenue, Pittsburg, Pa.,	21 00
181	R. Lee Walker, Duncansville, Pa.,	R. Lee Walker,	20 00
271	(Manufactured near Middletown, Pa.),...	S. B. Vance, Middletown, Pa.,	22 00

The percentage composition of these samples is as follows:

No.	Description.	Moisture.	Protein.	Fat.
97	Victor corn and oat feed,	10.33	8.38	3.42
280	Victor corn and oat feed,	9.99	7.88	3.28
283	Victor corn and oat feed,	9.17	7.88	4.07
252	Corn and oat feed,	9.87	9.00	3.72
235	Corn and oats chop,	9.62	9.25	4.26
156	Corn and oats chop,	9.63	8.69	3.97
247	Corn and oats chop,	10.13	8.94	3.52
42	Corn and oats chop,	10.34	8.63	3.95
78	Corn and oats,	11.44	8.44	3.58
59	Corn and oats (one-third corn, two thirds oats),	12.10	9.88	4.17
258	Oats and corn chop, ...	9.94	9.63	4.19
50	Corn and oats,	11.12	9.25	4.05
177	Corn and oats,	10.34	9.31	3.76
13	Corn and oats,	12.26	9.19	3.92
16	Corn and oats,	11.66	9.31	4.10
23	Corn and oats,	11.53	8.00	3.41
214	Corn and oats chop,	10.20	7.81	2.97
181	Corn and oats,	10.17	9.44	3.58
152	Corn and oats chop,	10.07	9.00	4.08
271	Corn and oats chop,	10.28	8.56	2.44
	Range,	9.17-12.26	7.81-9.88	2.97-4.26
	Average,	10.51	8.82	4.27

Not one of these feeds reaches, in either constituent, the average percentage for unadulterated corn and oats. On the other hand, both grains are sufficiently variable in composition to make it possible that any one of these feeds might have been made by mixing exceptionally poor lots of the two grains. Admitting this as a possibility in individual cases, it is nevertheless safe to say, upon the basis of these analyses, that there is almost no pure corn-and-oats feed on sale in the State and that the practice of diluting by admixture of oat hulls is well nigh universal. Assuming average composition for the three materials, a mixture of 58 parts corn, 31

parts oats hulls and 11 parts oats would contain about 8.8 per cent. of protein and 3.7 per cent. of fat. When it is considered that small quantities of corn cob are found in many of these samples, as in Nos. 97, 283, 259 and 214, whether purposely added or remaining after an imperfect cleaning of the corn after shelling, the possibilities of variation are more clearly perceived.

When it is seen that the average composition of these mixtures is about the same, or a little inferior in fat content, to that of the corn meal, that a very considerable proportion of the corn and oat feeds is composed of oat hulls whose nitrogen-free extract is much less digestible than corn, and yet that the average price paid for these feeds is about \$19.60, while that paid for corn chops and meals is \$19.35, the advantage of economy is seen to lie with the unmixed corn.

Of the brands examined, Victor Corn and Oat Feed is the only one analyzed in other States. The comparative data for this brand are:

	Number of analyses.	Protein, Per cent.			Fat, Per cent.		
		Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
Victor corn and oat feed:							
Pennsylvania,	2	7.88	7.88	7.88	4.07	3.28	3.68
New York, 1900,	4	8.7	7.1	8.1	4.6	2.9	4.78
New England, 1898-9,	26	11.3	9.5	9.2	5.1	2.9	3.9
All brands:							
Pennsylvania,	20	9.88	7.81	8.82	4.26	2.97	4.27
New York, 1899-1900,	17	9.37	6.8	8.03	4.6	1.6	3.22
New England, 1898-9,	43	12.3	8.2	9.3	7.1	2.7	3.8

In New York, 1900, the Victor brand was guaranteed to contain 8.23 per cent. protein and 3.00 per cent. fat. The New York analyses are up to this guarantee. A careful consideration of the above data shows that Pennsylvania receives goods of this class inferior, on the average, to those of New York, where the selling price is somewhat less, and that in both these States this class of goods is less rich than in New England, where systematic inspection of cattle foods has been longer practiced.

Closely related to the foregoing feeds are two other samples;

No. 80. Corn and oats hulls; made and sold by the Warren Mills Co., Warren, Pa., at \$19.00 per ton.

No. 192. Corn and cob meal and oats; made and sold by Clapper Bros., Martinsburg, Pa., price not given.

The percentage composition of these goods was:

	Number.	Moisture.	Protein.	Fat.
89,	11.62	8.63	3.12
192,	9.52	9.13	3.67

That is, these brands do not differ in composition from others sold under more misleading names.

Though sold under different names, the following feeds are also closely related to the foregoing:

No.	Manufacturer.	Dealer.	Price per ton.
124	Weston Mill Co., Scranton, Pa.,	Weston Mill Co.,	\$21 00
127	Weston Mill Co., Scranton, Pa.,	Weston Mill Co.,	19 00
153	.....	.....	.....

Analysis gave the following results (per cent.):

No.	Description.	Moisture.	Protein.	Fat.
124	Best mixed feed,	8.61	9.33	4.09
127	Regular mixed feed,	9.76	9.81	4.58
153	No accompanying description,	10.31	9.25	4.01

No. 124 shows, when optically examined, a larger proportion of corn chop than No. 127, and some excess of oat hulls. No. 153 has a preponderance of corn.

Other Mixed Stock Feeds.

In addition to the foregoing, a number of stock foods made of other combinations of materials have been received:

No	Manufacturer.	Dealer.	Price per ton.
155	.....	B. Cohn, Altoona, Pa., .....	.....
168	.....	H. Mulhollen, .....	.....
19	.....	I. L. Hockensmith,	\$18 00
48	American Cereal Co., Chicago, Ill.,	Israel S. Fry, Reading, Pa.,	17 00
267	American Cereal Co., Chicago, Ill.,	John B. Curry, Swatara Sta.,	19 00
162	T. M. Biddle, Altoona, Pa.,	T. M. Biddle, .....	.....
167	R. L. Walker, Duncansville,	R. L. Walker,	20 00
174	J. S. Brown & Son, Loysburg,	J. S. Brown & Son,	16 00
193	Bare Milling Co., Roaring Spring,	Bare Milling Co., .....	.....
163	P. W. Post, Altoona,	P. W. Post,	25 00
184	R. Lee Walker, Duncansville,	R. Lee Walker,	22 00

No.	Manufacturer.	Dealer.	Price per ton.
178	.....	(Sent by H. L. Harvey), ....	.....
11	.....	James Reeder,	16 00
49	James Heffner, Kutztown, Pa.,	Chas. W. Pennock, Reading,	20 00
38	Mann & Allshouse, Easton,	Mann & Allshouse,	22 00
37	Mann & Allshouse, Easton,	Mann & Allshouse,	20 00
272	Levi Brant, Harrisburg, Pa.,	Levi Brant,	23 00
170	Clapper Bros., Martinsburg,	Clapper Bros.,	22 00
194	Clapper Bros., Martinsburg,	Clapper Bros.,	24 00
52	M. C. Dietrich, Kempton, Pa.,	M. C. Dietrich,	22 00
63	H. H. Gring, Mohrsville,	H. H. Gring,	22 00
160	F. & I. Mentzer, Frankstown, Pa.,	F. & I. Mentzer,	20 00
182	G. W. Mock, Rodman's Mills, Pa.,	G. W. Mock,	23 00
65	John H. Schmehl, Scarlets Mill, Pa.,	J. H. Schmehl,	20 00
36	C. W. Walter, Walters, Pa.,	C. W. Walter,	22 00
39	C. W. Walter, Walters, Pa.,	C. W. Walter,	18 00
21	American Cereal Co., Chicago, Ill.,	John Thomas & Son, Johnstown, Pa.,	20 00
68	American Cereal Co., Akron, O.,	M. H. Clark, Uniontown, Pa.,	20 00
26	Toledo Grain and Milling Co., Toledo, Ohio,	Pennsylvania Traffic Co., Ltd., Johns- town,	21 00
122	Snyder Bros., Dalton, Pa.,	Snyder Bros.,	19 00
84	H. O. Company, Buffalo, N. Y.,	Simpson Bros., Norristown, Pa.,	22 50
85	H. O. Company, Buffalo, N. Y.,	Simpson Bros., Norristown, Pa.,	22 50
112	H. O. Company, Buffalo, N. Y.,	Frank H. Duffield, Langhorne,	20 00
115	H. O. Company, Buffalo, N. Y.,	Frank H. Duffield, Langhorne,	20 00
140	Brooks & Pennock, Philadelphia,	Snyder Bros., Dalton, Pa.,	18 50

The results of chemical and microscopical examination are given below. Under the heading "description" are stated the names under which the goods were sold.

Other Mixed Stock Foods.

Number.	Description.	Moisture, per cent.	Protein, per cent.	Fat, per cent.	Remarks.
<i>Wheat and Oats.</i>					
155	No description,	9.47	14.94	3.90	
168	No description,	9.37	13.31	6.35	
10	Quaker dairy feed,	8.40	10.94	4.73	Contains white corn; oat hulls.
48	Quaker dairy feed,	8.72	12.88	2.94	No corn found.
267	Quaker dairy feed,	8.65	9.00	2.82	Wheat dust abundant.
	Range,	8.05-9.47	9.00-14.94	2.82-6.35	
	Average,	8.80	12.23	4.15	
<i>Wheat and Corn.</i>					
162	Mixed feed,	10.19	8.69	2.77	Chiefly corn.
167	Corn and middlings,	10.13	12.88	4.30	A few oats present.
174	Mixed feed,	9.98	11.19	3.64	Chiefly bran with corn meal.
	Range,	9.98-10.19	8.69-11.19	3.64-4.30	
	Average,	10.60	10.92	3.90	
<i>Rye and Oats.</i>					
198	Rye and oats,	9.61	11.13	4.49	Contains yellow corn.
163	Rye and oats chop, one-half each,	10.22	10.21	2.53	
184	Rye and oats,	9.22	9.63	2.89	
178	Rye and oats,	10.22	13.63	3.05	Chiefly middlings with a little oats.
11	Rye and oats,	9.42	10.44	3.22	Hulls abundant.
	Range,	9.22-10.22	9.63-13.63	2.53-4.49	
	Average,	9.74	11.03	3.54	
<i>Rye and Corn.</i>					
49	Corn and rye,	11.13	11.31	3.28	Rye middlings and yellow corn.
38	Mixed feed (rye and corn), .....	.....	8.81	3.60	Contains little rye bran.
37	Mixed feed for horses (rye middlings and corn),	10.58	10.44	3.52	Considerable bran present.
	Range,	10.58-11.19	8.81-11.31	3.28-3.60	
	Average,	10.97	10.19	3.47	

Number.	Description.	Moisture, per cent.	Protein, per cent.	Fat, per cent.	Remarks.
<i>Corn, Oats and Rye.</i>					
272	Corn and oats and rye,	10.51	10.00	3.01	Proportion of oats small.
170	Rye, corn and oats chop, ..	9.70	10.88	4.99	Proportion of oats small.
794	Rye, corn and oats chop, ..	9.16	11.56	2.92	Rye predominant.
52	Corn, rye and oats,	10.81	9.13	2.78	Some cob present.
63	Corn, oats and rye chop, ..	9.57	9.00	3.55	Large proportion of oats.
169	Rye mixed chop,	9.27	11.13	3.33	Small proportion of corn.
182	Rye, corn and oats chop, ..	9.42	9.38	3.40	Proportion of hulls large.
65	Corn, oats and rye chop, ..	11.12	9.13	3.12	
36	Mixed feed No. 1, rye, corn and oats, ..	10.45	9.31	2.78-4.99	
	Range,	9.16-11.12	9.00-11.56	2.78-4.99	
	Average,	10.00	9.95	3.40	
<i>Corn-and-Cob Meal, Oats and Rye.</i>					
38	Ear corn, rye and oats,	9.48	8.94	3.27	Particles of cob not abnormal in quantity.
<i>Corn, Oats and Barley.</i>					
21	Corn, oats and barley,	7.30	10.63	4.37	
68	Corn, oats and barley,	8.07	10.31	4.76	
26	Corn, oats and barley,	11.09	7.38	2.96	Large proportion of hulls.
	Range,	7.30-11.09	7.38-10.63	2.96-4.76	
	Average,	8.82	9.44	4.03	
<i>Corn, Oats and Wheat.</i>					
122	Corn, oats and bran feed,	9.89	9.13	3.55	Some cob present; oat hulls abundant; bran not prominent.
<i>H. O. Feeds.</i>					
85	H. O. dairy feed,	8.93	16.56	3.22	Oat hulls prominent; corn, wheat and cotton-seed meal.
112	H. O. dairy feed,	9.39	16.88	3.55	
	Average,	9.16	16.72	3.39	
84	H. O. horse feed,	9.78	11.06	3.53	Oat hulls prominent; cracked corn, wheat middlings and a little linseed meal.
111	H. O. horse feed,	9.08	10.88	2.99	
	Average,	9.43	10.97	3.26	
14	Sucrene dairy feed,	9.32	14.00	2.43	Reducing sugars, 6.31 per cent. roasted corn, oat hulls and linseed detected.

Assuming that the mixtures named should be made up from the un-separated products from the milling of the whole grains, that the grains are of average composition and that they enter in equal proportion into the mixtures, their percentage composition would be as follows:

Mixture.	Moisture.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
Wheat and oats,	10.7	2.4	11.8	5.7	65.8	3.6
Wheat and corn,	10.5	1.7	11.1	2.0	71.1	3.6
Rye and oats,	11.3	2.4	11.2	5.6	68.1	3.4
Rye and corn,	11.1	1.7	10.4	2.0	71.4	3.4
Corn, oats and rye,	11.1	2.1	10.9	4.5	67.5	3.9
Corn-and-cob meal, oats and rye,	12.6	2.1	10.3	5.9	65.7	3.4
Corn, oats and barley,	10.8	2.3	11.5	4.8	66.7	3.9
Corn, oats and wheat,	10.7	2.1	11.3	5.5	67.4	4.0
Corn, oats and wheat bran,	11.2	3.4	12.5	6.9	61.3	4.7

Variations in the proportions of the several grains will produce some variation in the products, but it is interesting to observe how slight the differences are between the percentages of protein and fat in the foregoing mixtures.

Comparison of the data presented in the foregoing table and the analytical results from the examination of the mixed stock feeds will at once reveal many cases of abnormal composition, due in a large proportion of cases to the use of oat hulls as an admixture, in some instance, to the presence of corn in great excess over the other grains named.

Most of the samples examined represent goods made solely for local use; a few are sold in many States:

Quaker Dairy Feed, made by the American Cereal Co., of Chicago, is composed of wheat and oats products; no guaranty accompanied the sample, but in New York and New England it is guaranteed to contain 12.03 per cent. of protein and 2.5 per cent. of fat; the Connecticut Bulletin 133 gives the results of 28 recent analyses as 13.53 per cent. protein and 3.13 per cent. fat. The samples analyzed here show a considerably inferior composition. The makers of sample No. 10 are not reported; it differs from the others in containing considerable quantities of white corn, its protein being decreased and its fat increased as a result.

Corn, Oats and Barley also made by the American Cereal Company, is represented by samples Nos. 21 and 68. No guaranty of composition accompanied them. The average of six recent New England analyses gives 11.9 per cent. of protein and 4.5 per cent. of fat. The Pennsylvania samples are considerably inferior.

Sample 26, of the same name, but reported as made by the Toledo Milling Company, is very far inferior, containing a very large proportion of hulls.

H. O. Dairy Feed, made by the H. O. Company of Buffalo, and composed of oat hulls with corn, wheat and cotton-seed meal, is represented by samples 85 and 112. It is guaranteed to contain 18.46 per cent. of protein and 4.53 per cent. of fat. The average of nine recent New England analyses is 18.06 per cent. of protein and 4.01 per cent. of fat. The Pennsylvania samples are far inferior.

H. O. Horse Feed, made by the same company, and containing a little linseed instead of cotton-seed meal, is guaranteed to contain 12.42 per cent. of protein and 4.54 per cent. of fat. The average of 18 recent New England analyses is 12.4 per cent. of protein and 4.2 per cent. of fat. Again, Pennsylvania samples are inferior.

Sucrene Dairy Feed, reported as made by Brook and Pennock, of Philadelphia, is accompanied by no guaranty. Its chief proteid ingredient is linseed meal; by roasting, the other substances contained have been darkened; a considerable proportion of reducing sugars is present. An analysis made by the Massachusetts Station (B. 64, p. 22), shows 18.69 per cent. protein and 2.97 per cent. fat.

SPECIAL POULTRY FOODS.

A number of "poultry foods" were examined:

No.	Manufacturer.	Dealer.	Price per ton.
89	Simpson Bros., Norristown,	Simpson Bros.,	\$26 00
131	Bennett & Millett, Gouverneur, N. Y., ...	Snyder Bros., Dalton,	40 00
138	Smith & Romain, New York,	Snyder Bros.,	25 00
142	American Cereal Co., Chicago, Ill.,	Snyder Bros.,	25 00
148	(Shipped from Philadelphia),	Snyder Bros.,	17 00

The descriptions and analyses of these foods are as follows:

No.	Description.	Moisture.	Protein.	Fat.
89	Superior poultry food,	11.00	13.50	4.15
131	Clover meal for poultry,	9.27	6.38	2.00
138	Boiled beef and bone for poultry,	5.84	42.63	17.97
142*	American poultry food,	9.45	11.75	4.93
148	Rice feed for poultry,	8.55	10.94	9.28

* Said to be composed of corn, oats, wheat and barley.

Microscopic examination indicates that No. 89, Simpson's Poultry Food, is a mixture of middlings, oats and corn; the proportion of hulls seems rather excessive.

No. 131, "Clover Meal," appears to be very fine-cut clover hay.

No. 138 shows nothing foreign to the name.

No. 142, composed, as classified, of oats, corn, wheat and barley.

No. 148 composed chiefly of rice hulls and polish.

Of these goods, several are worthy of further remark: The price of No. 131, even after the most extreme allowance for the expense of retailing in small quantities, is altogether out of proportion to the food value. Clover hay has an average of 12.3 per cent. protein, sometimes rising to 20.9 per cent., and an average of 3.3 per cent. of crude fat or ether-extract, sometimes reaching 5.9 per cent. The shatterings, commonly used on the farm as a poultry food, are still richer in protein. A Connecticut analysis gives for this poultry food, 9.5 per cent. protein and 2.42 per cent. fat, a much higher value.

The proportion of fat in the rice feed, No. 148, is unusually high, otherwise the composition is normal; the range of composition for the more important rice by-product, obtained by the investigations of a number of the Southern experiment stations is:

	Protein, per cent.	Fat, per cent.
Rice bran,	10.9-13.6	5.2-10.9
Rice hulls,	2.9-4.7	0.6-0.9
Rice polish,	10.9-12.9	6.5-8.0

A large proportion of the food is evidently derived from the polish.

American Poultry Food, represented by sample No. 142, is on sale in other States and has been guaranteed in New York State to contain 13.65 per cent. of protein and 3.96 per cent. of fat. The average of nine recent analyses in States having food controls shows 13.20 per cent. of protein and 6.20 per cent. of fat. The Pennsylvania sample is conspicuously inferior.

CONDIMENTAL FOODS.

Two samples of foods of this class were received:

No.	Manufacturer.	Dealer.	Price per ton.
87	Simpson Bros., Norristown, Pa.,	Simpson Bros.,	\$160 00
254	John W. Barwell, Waukegan, Ill.,	F. L. Heath, Corry, Pa.,	70 00

No. 87, Simpson Bros'. Condimental Stock Food is stated by them to have given good satisfaction in general use in their locality. The percentage composition, in terms of the ordinary food analysis, is as follows:

	Per cent.
Moisture,	13.50
Ash,	16.96
Protein,	7.25
Fiber,	9.38
Nitrogen-free extract,	50.41
Fat,	2.50
	<hr/>
	100.00
	<hr/>

The composition of the ash is such as to indicate the presence of 4.91 per cent. of common salt and about 13.28 per cent. of Epsom salts; a very considerable amount of iron is also present, probably in the form of oxid.

Microscopical examination indicates that the principal vegetable material present is the hulls, glumes, palets and a portion of the cob of corn, together with some starch; bits of charred matter also appear. The material has a slightly defined aromatic odor.

No. 254, Blatchford's Calf Meal, has been frequently examined. It is claimed to be "The Perfect Milk Substitute," but the directions show that it is to be used in connection with the other foods commonly given to calves at their several stages of growth. It is claimed to be chiefly composed of the "carob" or "locust bean" meal with leguminous seeds, such as the lentil, and oleaginous seeds, such as flax seed, and to contain no cheap mill feeds.

On analysis, the following results were obtained:

	Per cent.
Moisture,	7.20
Protein,	23.94
Fat,	4.70
	<hr/>

The average of six recent analyses (Connecticut Station, Bulletin 133, page 28) shows 24.45 per cent. protein and 4.62 per cent. fat.

The carob-bean has recently been investigated by the Connecticut Station (B. 130, p. 21). In 100 parts of the pod fruit there are 7.5 per cent. of seeds and 92.5 per cent. of empty husk or pod. The percentage composition of the several parts and of the whole is:

	Seeds.	Husks.	Full pod.
Moisture,	12.84	14.15	14.05
Ash,	3.27	3.25	3.26
Protein,	15.00	4.81	5.57
Fiber,	7.16	4.80	4.98
Nitrogen-free extract,	59.90	72.77	71.80
Fat,	1.83	.22	.34
	100.00	100.00	100.00

These figures agree with European analyses.

The composition of the "calf meal" and the carob bean are too different, therefore, to make it possible for the latter to constitute the greater part of the former. Dr. A. L. Winton, of the Connecticut Station, found linseed meal to be the chief constituent, and beside the carob bean, there were also present cotton-seed meal, a wheat product and fenugreek. These findings agree essentially with those of our microscopic examination of sample No. 254.

Composition of Other Condimental Foods.

Within the past year or two, extensive examinations, chemical and microscopical, have been made of the more commonly sold condimental foods. This work has been especially taken up by the Connecticut and Massachusetts Experiment Stations, though others have added work of value.

Owing to the prevalence of this class of goods in this State, it has been thought of interest to present in compendious form, the results of these investigations. The food analyses, made for the purpose of determining the proportions in which the ordinary food constituents are present, will be grouped in tabular form. The results of microscopical and special chemical examinations will be separately presented. The prices per ton affixed are calculated from the pound prices at which the goods are retailed; doubtless these rates could be greatly reduced in wholesale transactions in these several trade articles, but owing to the large claims commonly advanced as to the nutritive effect of these materials when consumed in small quantities, the comparison of prices by the method adopted is not an unfair one.

American Cattle Feeding Salts, made by the American Cattle Feeding Salts Co., 138-140 55th street, New York city, John M. Draper, Agricultural and Research Chemist, Manager. Price not stated. Claimed to consist of "various tonic substances and natural salts," which when added to other feeds is a means of growing prime beef, brighter in color, wavy or marbled in texture, and with pure white fat, in much less time than under the present system of feeding." Analysis by the Connecticut Station shows:

	Per cent.
Common salt,	16.0
Glauber's salts,	63.5
Epsom salts,	4.8
Carbonate of soda,	9.3
Matter insoluble in water,	1.5
Water and other volatile matter,	4.9
	<hr/>
	100.0
	<hr/>

American Spice Food, made by the American Spiced Food Co., Boston. Price not stated. Found by the Massachusetts Station (B. 71, pp. 28-9) to consist chiefly of corn with an addition of pepper.

American Triumph Horse and Cattle Food, made by McKenzie and Winslow, Fall River, Mass. Price \$200 per ton. According to the Massachusetts Station (Bulletin 71, p. 28) it is chiefly composed of corn, barley and some material rich in protein, with some charcoal and an aromatic substance like fenugreek.

American Triumph Poultry Food, made by the same firm. Price \$200 per ton. According to the Massachusetts Station (*Loc. cit*) it is chiefly composed of rye, corn, barley and some material rich in protein, together with pepper and an aromatic like fenugreek.

Anglo-American Food for Stock made by the Anglo-American Mfg. Co., Boston. Price \$360 per ton. Food analysis made by the New York Experiment Station (Bulletin No. 267), but no report made upon the nature of the ingredients.

Anglo-American Poultry Food, made by the same company. Price not stated. According to the Massachusetts Station (B. 71, p. 30) it is chiefly composed of wheat and rye brans, together with corn, some materials rich in protein, charcoal and pepper.

Banner Poultry Food, made by the Banner Food Co., Auburn, N. Y. Price \$200 per ton. According to the Massachusetts Station (*Loc. cit*) it is chiefly composed of linseed meal and wheat offals, together with some salt, charcoal and phosphate of lime.

Banner Stock Food, made by the same company. Price not stated. Is composed, according to the Massachusetts Station, chiefly of linseed meal, together with wheat offals, oats, charcoal, salt and sulfates, probably in the form of Glauber's salts.

Barwell's Horse and Cattle Food, made by John W. Barwell, Waukegan, Ill. Price \$120 per ton. Is chiefly composed of linseed meal with, perhaps, some flaxseed meal and other ingredients not determined (Massachusetts Station).

Baum's Poultry Food, made by Baum's Castorine Company, Syracuse, N. Y. Price \$250 per ton. According to the Connecticut Sta-

tion (B. 132, p. 5) this is composed of linseed meal, wheat feed, cayenne pepper, charcoal, salt, Epsom salts, iron oxid and sulfur; the latter is present in the "crude fat" to the amount of 6.73 per cent. of the entire material. The salt amounts to 5 per cent. approximately.

Baum's Stock Food, made by the same company. Price \$180 to \$200 per ton. According to the Connecticut Station (*Loc. cit.*) it is composed of linseed meal, charcoal, salt, Epsom salts and sulfur; the same finding was made by the Massachusetts Station. There is 3.5 per cent. of salt and about 4 per cent. of free sulfur present, with probably 3 per cent. of Epsom salts.

Benjamin's Food for Horses and Cattle, made by Benjamin's Food Co., Danbury, Conn. Price \$250 per ton. Composed of linseed meal, wheat feed and fenugreek (Conn. Sta., B. 132, p. 5).

Benjamin's Poultry Food, made by the same company. Price \$250 per ton. According to the Connecticut Station, it is composed of linseed meal, wheat feed, corn meal, cotton-seed meal and mustard hulls.

Champion Horse and Cattle Food, made by the Champion Food Co. Price \$300 per ton. Chiefly composed of corn, with linseed, rice, charcoal, salt and sulfates, probably Glauber's salts.

Climax Stock Food, made by L. B. Lord, Burlington, Vt. Price \$210 per ton. Composed, according to the Massachusetts Station, chiefly of wheat and barley, together with salts and copperas. The New York Station found in one sample a very large quantity of sulfur, constituting most of the ether-extract.

Colonial Poultry Food, made by the Puritan Mfg. Co., Rochester, N. Y. Price not stated. Composed chiefly of barley and other cereals, charcoal, salt and pepper. (Mass. Sta., B. 71, p. 30.)

Colonial Stock Food, made by the same company. Price \$200 to \$275 per ton. Composed, according to the Massachusetts Station, of wheat, a large amount of charcoal, salt and a condiment resembling fenugreek.

Dow's Poultry Meal, made by J. C. Dow, Boston. Price \$300 per ton. Composed, according to the Massachusetts Station, of meat, bone, salt and oyster shells.

Eggine, made by the Eggine Co., Hartford, Conn. Price not stated. Composed, according to the Massachusetts Station, chiefly of fine ground oyster shells, with animal matter, pepper, charcoal and Epsom salts.

Eureka Egg Food, Jos. Breck's Sons Corporation, Boston, Mass. Price not stated. Composed of cereals, highly proteid material, charcoal, salt and oyster shells (Mass. Sta., B. 71, p. 30).

Flagg's Poultry Food. Price \$240 per ton. Composed, according to the Massachusetts Station, of corn, wheat offal, pepper, salt, charcoal, Epsom salts and Venetian red.

Flower City Horse and Cattle Food. Maker and price not stated. No details given as to the nature of the ingredients.

Dr. Hess's Poultry Punacea, made by Dr. Hess and Clark, Ashland, O. Price \$340 per ton. Composed, according to the Connecticut Station, of wheat feed, charcoal, salt, carbonate of lime and iron oxid (Venetian red); nearly 12 per cent. of salt is found present. The Massachusetts Station reports the presence of barley and Epsom salts in addition.

Dr. Hess's Stock Food, made by the same firm. Price \$140 per ton. According to the Massachusetts Station, it consists chiefly of bran, together with a material high in protein, charcoal, salt, iron, Glauber's salts, and a condiment resembling fenugreek.

Ideal Egg Food, made by the Poultry Supply Co., Boston. Price not stated. Composition, according to the Massachusetts Station, chiefly of cereals, with material high in protein, pepper, charcoal, iron, carbonate of lime and Glauber's salts.

International Poultry Food, made by the International Food Co., Minneapolis. Price \$250 per ton. Examination at the Connecticut Station shows it to be composed of wheat feed, cayenne pepper, a bitter drug, charcoal and salt, about 2.25 per cent.

International Stock Food, made by the same company. Price \$250 to \$400 per ton. Composed, according to the Connecticut Station, of wheat feed, cayenne pepper, charcoal, salt (8.38 per cent.) and a bitter drug resembling gentian. This finding is, in the main, confirmed by the Massachusetts Station.

Jersey Tonic and Condition Powder, made by H. A. Esterbrook, Fitchburg, Mass. Price \$360 per ton. Composed of wheat offal, ground herbs, pepper, Glauber's salts and Venetian red. (Mass. Sta., B. 71, p. 30.)

Knight's English Vegetable Food, made by Knight's Stock and Poultry Food Co. Price \$140 per ton. Composition, chiefly wheat offal, with rye, corn, charcoal, salt and a condiment resembling fenugreek. (Mass. Sta., B. 71, p. 30.)

Knight's Poultry Food, made by the same company. Price \$200 per ton. Composed chiefly of bran, with corn, some material rich in protein, salt, sand and an aromatic resembling fennel.

Lightning Horse, Cattle and Poultry Powders, made by the Herb Medicine Co., Springfield, O. Price \$400 per ton. Analyzed by Virginia Station (B. 107, p. 232); no statement is made concerning the ingredients save that the ether-extract is chiefly composed of sulfur.

McClaren's English Horse Food, made by McClaren, Brockton, Mass. Price not stated. Composed chiefly of corn, oats, wheat, rice and a bitter substance resembling gentian. (Mass. Sta., B. 71, p. 28.)

Magic Poultry Food and Egg Producer, made by Magic Food Co., Chattanooga and St. Louis. Price \$250 per ton. Analysis by Virginia Station without details as to the nature of the ingredients.

Magic Stock Food (Mansfield), made by the same company. Price \$250 per ton. Analysis as in case of the previous food.

Chas. Marvin Stock Food, manufacturer not named. Price \$1,000 per ton. Ordinary food analysis made by the New York Station without detail as to the nature of the ingredients. (B. 166, p. 267.)

Matthews Compound Food, made by Eastman Bros., Framingham, Mass. Price not stated. Chiefly composed of cereals with the addition of linseed meal and salt. (Mass. Sta., B. 71, p. 28.)

Medicated Meal, made by F. C. Sturtevant, Hartford, Conn. Price \$400 per ton. Composed of linseed meal, corn meal, ginger, fenugreek, a bitter drug and sulfur (about 3 per cent.) (Conn. Sta., B. 132, p. 5.)

Myers' Royal Horse and Cattle Spice, Myers', Niagara Falls, N. Y. Price \$200 to \$250 per ton. Composed, according to the Connecticut Station, of linseed meal, corn meal, wheat feed, malt sprouts, mustard hulls, turmeric, cocoa shells, salt and fenugreek. The Massachusetts Station indicates the additional presence of rice, oat and bean meals; the salt amounts to 16.5 per cent.

Myers' Royal Poultry Spice, made by the same firm. Price \$300 to \$350 per ton. Composition, according to the Connecticut Station, like the foregoing with the omission of the malt sprouts and the addition of cayenne. The Massachusetts Station reports the presence of rape seed. The salt, in the sample examined by the Connecticut Station, amounts to nearly 13 per cent.

Nutritone, made by the Thorley Food Co., Chicago. Price \$320 to \$500 per ton. This is one of the older condimental foods on the market and has been frequently examined. A recent examination by the Connecticut Station shows the presence of linseed and cottonseed meals, corn meal, wheat feed, salt (13.10 per cent.), charcoal, sulfur (.83 per cent.) and fenugreek. The Massachusetts Station reports the presence of bean meal.

Oarge E-c-r-i-c Food, made by G. E. Vincent, Catskill, N. Y. Price \$340 per ton. Composed of corn and linseed meals, charcoal and sulfur (.4 per cent.) (Conn. Sta., B. 132, p. 5.)

Pratt's Animal Regulator, made by the Pratt Food Co., Phila., Pa. Price \$320 to \$500. Composed, according to the Connecticut Station, of corn meal, salt (10.11 per cent.), charcoal, fenugreek and a bitter substance resembling gentian. The Massachusetts Station reports the presence, in addition, of fennel and Glauber's salts.

Pratt's Horse and Cattle Food, made by the same firm. Price \$146.67 per ton. Composed chiefly of cereals and beans with fennel. (Mass. Sta., B. 71, p. 28.)

Pratt's Poultry Food, made by the same company. Price \$240 to \$320 per ton. The Connecticut Station found the following ingredients, corn meal, wheat feed, iron oxid, sulfur (.81 per cent.), and a bitter drug. The Massachusetts Station reports upon one sample in about the same terms with the addition of cayenne, but upon another as composed of corn, bean and rice meals, pepper, Venetian red and fenugreek.

Prolific Poultry Food, made by L. B. Lord, Burlington, Vt. Price not stated. Composed of animal matter, linseed husks, charcoal, sand, salt, Epsom salts and carbonate and phosphate of lime. (Mass. Station.)

Rochester Horse and Cattle Food, made by the Rochester Horse and Cattle Food Co., Rochester, N. Y. Price \$500 per ton, pound package price; \$170 in 200 pound lots. The Pennsylvania Station (Rep. 1899, p. 172) found it to contain wheat offal, some richly proteid material, salts, charcoal, an aromatic and a bitter substance.

Royal Stock Food, name of maker not stated. Price \$125 per ton. Food analysis without detail as to ingredients by the New York Station.

Rust's Egg Producer, made by Wm. Rust & Sons, New Brunswick, N. J. Price \$500 per ton. Chiefly composed of shells and charcoal, together with some material rich in protein and pepper. (Mass. Station.)

Sheridan's Condition Powder, made by I. S. Johnson & Co., Boston. Price \$2,600 per ton. Composed of linseed, cellular matter, ginger, pepper, charcoal, carbonate and phosphate of lime and Epsom salts. (Mass. Station.)

Stanley's Condition Powder, made by J. J. Stanley, Lawrence, Mass. Price \$120 per ton. Composed chiefly of wheat and corn with salt and fenugreek. (Mass. Station.)

Thorley's Horse and Cattle Food, made by The Thorley Food Co., Chicago, Ill. Price not stated. Chiefly composed of rice and linseed, with beans, salt and fenugreek. (Mass. Station.)

Triplex Poultry Food, made by the Triplex Food Co., New Brunswick, N. J. Price \$240 to \$340 per ton. Composed of linseed meal, wheat feed, charcoal, ground bone, lime carbonate, iron oxid and sulfur (nearly 1 per cent.) (Conn. Station.) The Massachusetts Station finds, in addition, corn, pepper and Glauber's salts.

Triplex Stock Food, made by the same company. Price not stated. Food analysis, without detail as to ingredients, by the New York Station.

Weston's Condition Powder, made by J. W. Weston, New York city. Price \$320 per ton. Composed of wheat, corn, bean and linseed meals, with fenugreek. (Mass. Station.)

White's Stock Food, made by the White Food Co., Taunton, Mass. Composed chiefly of bran with an admixture of fenugreek. (Mass. Station.)

Wilbur's Egg Food, made by Wilbur's Seed Meal Co., Milwaukee, Wis. Price \$222 per ton. Analysis without description of ingredients by the Virginia Station.

Wilbur's Seed Meal, made by the same company. Price not stated. Analysis without statement of ingredients by the New York Station.

The results of the food analyses of the foregoing foods, together with an indication of the number of analyses upon which the statement is based and the sources from which they are drawn, are given in the following table. It should be borne in mind that the presence of mineral drugs in the condimental foods leads to some variation in the composition of the several groups of materials separated by the common analytical processes; thus, the free sulfur appears with the fat, the charcoal with the fiber, and, since the nitrogen-free extract is computed by subtracting the sum of the other groups from 100, it represents, in cases where large quantities of oyster shell have been admixed, not only sugar, starch and the usual constituents but also so much of the carbonic acid as is driven off from the shells in making the ash determination.

In this connection, it may be noted that the analyses of different Stations and even analyses of different packages by the same Station, show a tendency to very little uniformity of composition in most of these foods and point, in some cases, to a change of formula at convenience.

Food Analyses of Condimental Foods (per cent.).

Name.	Number of analyses.*	Moisture.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
American Spiced Food,	1m	10.41	2.28	12.81	2.90	67.70	3.91
American Triumph Horse and Cattle Food,	1m	10.94	6.95	14.94	8.96	53.21	5.40
American Triumph Poultry Food,	1m	9.14	5.54	15.22	9.79	54.76	5.56
Anglo-American Food for Stock,	1n	7.20	13.28	15.50	7.86	25.80	4.85
Anglo-American Poultry Food,	1m	7.99	5.33	16.06	8.70	56.59	5.33
Banner Poultry Food,	1m	8.73	11.29	19.94	12.27	41.12	6.50
Banner Stock Food,	1m	8.88	9.35	23.56	15.24	38.01	4.96
Barwell's Horse and Cattle Food,	1m	7.52	6.41	20.72	5.36	50.47	9.72
Baum's Poultry Food,	1c	6.95	16.68	19.53	15.40	32.62	8.82
Baum's Stock Food,	2cmn	9.07	9.68	26.52	16.47	30.79	7.47
Benjamin's Food for Horses and Cattle,	1c	6.92	5.52	27.82	7.57	45.92	6.25
Benjamin's Poultry Food,	1c	7.05	5.42	29.19	8.44	42.92	6.98
Champion Horse and Cattle Food,	2mn	9.55	12.52	11.72	4.18	57.43	4.60
Climax Stock Food,	2mn	8.72	18.09	9.99	4.42	38.06	20.72

Name.	Number of analyses.	Moisture.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
Colonial Poultry Food,	1m	9.71	6.85	10.00	4.84	65.82	2.78
Colonial Stock Food,	2mn	8.97	11.04	10.46	10.45	56.27	2.81
Dow's Poultry Meal,	1m	20.22	36.75	30.50	2.06	.....	2.02
Eggine,	1m	.73	58.74	3.06	14.78	20.75	1.94
Eureka Egg Food,	1m	5.98	20.79	16.50	7.78	44.34	4.61
Flagg's Poultry Food,	1m	8.34	9.14	13.97	5.85	58.92	3.78
Flower City Horse and Cattle Food,	1n	9.27	11.29	14.37	9.70	50.25	5.12
Dr. Hess's Poultry Panacea,	3cm	8.22	29.00	11.65	4.86	44.36	1.91
Dr. Hess's Stock Food,	1m	7.82	13.08	16.19	7.11	52.55	3.25
Ideal Egg Food,	1m	8.02	13.98	18.50	9.19	45.49	4.82
International Poultry Food,	1m	6.79	7.87	14.88	13.97	49.69	6.80
International Stock Food,	3cmn	7.78	10.05	15.05	2.61	50.20	7.31
Jersey Tonic and Condition Powder,	1m	11.41	11.98	14.07	7.21	52.04	3.19
Knight's English Vegetable Food,	1m	8.59	12.69	15.25	7.47	51.47	4.53
Knight's Poultry Food,	1m	7.27	22.82	14.69	7.21	44.29	3.72
Lightning Horse, Cattle and Poultry Powders,	1v	11.15	3.05	17.44	2.70	38.48	26.18
McClaren's English Horse Food, ..	1m	11.05	5.83	10.38	1.43	67.96	3.35
Magic Poultry Food and Egg Producer,	1v	2.67	18.03	11.19	18.81	44.85	4.45
Magic Stock Food,	1v	8.10	5.39	11.00	22.45	47.82	5.24
Chas. Marvin Stock Food,	1n	8.26	5.97	30.94	10.63	39.92	4.28
Matthew's Compound Food,	1m	10.88	10.98	15.38	3.34	54.39	5.03
Medicated Meal,	1c	6.34	8.94	24.10	10.98	39.08	10.56
Myer's Royal Horse and Cattle Spice,	3cm	9.11	13.11	17.32	5.85	50.90	3.71
Myer's Royal Poultry Spice,	2cm	8.28	11.64	16.50	7.14	51.56	4.88
Nutritone,	3cmn	7.56	18.17	20.19	5.09	43.52	5.4
Orange Electric Food,	1c	6.80	4.00	15.03	7.81	58.92	7.44
Pratt's Animal Regulator,	2cm	7.89	11.70	9.91	2.23	62.80	4.4
Pratt's Horse and Cattle Food,	2mm	8.29	5.82	14.97	6.21	57.50	7.21
Pratt's Poultry Food,	3cm	8.35	6.70	14.78	6.22	56.26	7.69
Prolific Poultry Food,	1m	8.39	23.99	20.19	9.21	31.67	6.55
Rochester Horse and Cattle Food, ..	2np	8.40	9.74	16.32	11.70	47.74	6.10
Royal Stock Food,	1n	5.56	44.07	11.25	9.73	25.87	3.52
Rust's Egg Producer,	1m	4.56	52.51	19.31	6.52	13.57	3.53
Sheridan's Condition Powder,	2m	7.57	16.50	16.00	15.97	30.62	14.24
Stanley's Condition Powder,	1m	9.35	5.46	13.13	5.83	61.91	4.32
Thorley's Horse and Cattle Food,	1m	10.55	9.92	19.19	9.80	44.73	5.81
Triplex Poultry Food,	2cm	5.72	39.80	18.17	5.27	26.53	4.51
Triplex Stock Food,	1n	7.10	12.05	15.31	6.31	53.57	5.66
Weston's Condition Powder,	1m	9.31	5.09	15.63	5.90	59.27	4.70
White's Stock Food,	1m	10.21	5.79	15.81	10.44	52.33	5.42
Wilbur's Egg Food,	1v	7.72	10.14	18.43	12.23	46.26	4.22
Wilbur's Seed Meal,	1n	7.13	12.16	20.00	8.18	46.90	5.63

*c, Connecticut Station; m, Massachusetts Station; n, New York (Geneva) Station; p, Pennsylvania; v, Virginia Station.

The most striking feature about these materials is their enormous cost to the purchaser, \$100 to \$2,000 per ton. Their direct cost to the manufacturer is quite another matter. Their major proportion by weight is composed of ordinary feeding stuffs, costing at retail from \$15 to \$40 per ton. In a few cases, especially of so-called "egg-foods," they are more largely composed of oyster shells, whose market value is certainly much less. The other ingredients that enter into their composition in at all important quantities are bone, charcoal, flowers of sulfur, common salt, Glauber's salts, Epsom salts and Venetian red; while there are also added certain spicing, aromatic or bitter substances in small quantity.

The wholesale prices of some of the less common materials, as given by the *Oil, Laint and Drug Reporter* of New York, for July 8, 1901, are:

	Cents per pound.
Epsom salts, .....	.9 to 1.25
Flowers of sulfur,	1.85 to 2.05
Venetian red,	1.8 to 3.0
Ginger root,	4 to 4.25
Anise seed,	7.75 to 8.5
Fenugreek,	2.0 to 2.25
Fennel seed,	5.0 to 6.0

There is therefore no reason in the cost of the ingredients for the very great charges made for these mixtures.

In the second place, it is evident that the makers use much the same range of ingredients but select individual materials and proportions differently. The one common characteristic is the claim each makes, first, for the great nutritive value of very small quantities of his article of manufacture, and in most cases, second, for its medicinal value for a wide range of diverse ailments. Clearly, since exact selection of material and proportion is of so little importance, any reader of this paragraph can make a "condition powder" for his own stock with as good prospect of valuable results and at a very great saving of cost.

But as to the value of such condimental and semi-medicinal preparations: First, as used for healthy animals. Any direct nutritive value they possess is due to the common feeding stuffs they contain, but the quantities fed are too insignificant to cause considerable gains in production. Any indirect value they may have must be due to some economy of the other foods with which they are always directed to be fed, such economy being in the way of increased digestion of the food or its better utilization by the animal after digestion. A number of careful experiments have been made to determine the fact of such effect from condimental foods, but in not a single instance is there evidence of any economic action of the kind.

As to their supposed medicinal action: The ingredients commonly found have different effects. Some are used in veterinary practice as stomachics, stimulating the coatings of the stomach and bowels—anise seed, cayenne pepper and black or white pepper in doses of 2 drachms, fennel seed in doses of 1 drachm and ginger root in doses of 1 oz. Stomachics are employed in cases of pronounced indigestion; the doses are not expected to be given except on rare occasions. Charcoal is useful to reduce accumulations of gas; for this purpose considerable doses must be administered.

Epsom and Glauber's salts are used as purgatives; the former in

doses of 1 to 2 pounds act as a laxative for the ox, the latter in doses of 1½ pounds as a purgative for the horse. Sulfur, also, in doses of 1 oz. acts as a laxative; in doses of 3 to 4 oz. the latter acts to stimulate the perspiratory glands.

Gentian is frequently used as a bitter tonic, with decided laxative and stomachic effects; and iron oxid is also employed as a tonic.

So far as the stomachics are concerned, those of the usual condimental foods are often of the least efficient character, such as fenu-greek, which is not often included in modern lists of *materia medica*.

The quantities of the condimental foods necessary to be fed to give the usual medicinal dose of any one of the medicinal ingredients are very large. Especially should it be urged that a sick animal needs specific treatment for its particular ailment. That beneficial results are sometimes found to attend the use of condimental foods is admitted, but the benefit is gained at an unnecessary cost and is rather accidental than the logical result of a discriminating treatment.

The increased appetite often observed to follow the use of such foods, might often be secured by any change of diet, especially by the proper use of salt. Mild laxative effects are better secured by green food and a proper use of mashes in the diet. If tonic effects are desired, use the known materials for producing such effects and in the requisite quantities. See that fowls have the necessary access to cracked bone or oyster shells to furnish the egg shell materials.

In view of their great cost, of their comparatively small direct nutritive value, their lack of indirect nutritive value, their weakness and uncertain fitness as medicinal agents, the use of such commercial mixtures seems entirely unwarranted.

RELATIVE COST OF FEEDING STUFFS AS SOURCES OF PROTEIN.

In the introductory paragraphs of this bulletin it has been noted that the principal purpose in the introduction of the commercial feeding-stuffs upon the farm is to secure an increased proportion of protein in the farm rations. It will be of interest therefore to compare the expenditure required in purchasing some convenient unit quantity, say 20 pounds, of this nutrient in the various classes of commercial feeds.

This method of comparison is further justified by reason of the fact that protein is usually the chief variable among the several groups of food constituents present. On the other hand, it would be evidently incorrect to charge the protein with the entire cost of the feeding-stuff, the major portion of which is composed of other materials of some value.

Commercial Feeding Stuffs Arranged According to Their Percentage of Protein.

	Protein.	Fat.	Cost per ton	Expenditure in buying 20 pounds of protein.
Cottonseed meal,	44.40	10.10	\$27.50	0.619
Linseed meal, new process,	34.25	2.63	27.67	0.808
Linseed meal, old process,	34.10	3.04	28.56	0.838
Buckwheat middlings,*	31.08	8.77	18.00	0.580
Gluten feed,	24.72	2.84	18.33	0.741
Malt sprouts,	22.96	1.61	16.17	0.704
Germ oil cake,*	22.56	9.77	22.50	0.997
Red dog flour,	19.14	4.87	19.44	1.016
H. O. dairy feed,	16.72	3.29	21.23	1.271
Wheat shorts,	16.52	5.18	19.33	1.170
Buckeye wheat feed,*	16.50	4.52	20.00	1.212
Wheat middlings,	16.05	4.60	19.31	1.203
Wheat bran,	15.30	4.48	18.85	1.232
Wheat feeds,	14.21	3.90	19.33	1.360
Sucrene dairy feed,	14.00	2.42	18.50	1.321
Sugar corn feed,*	12.81	2.72	14.00	1.033
Wheat and oats feed,	12.23	4.15	18.00	1.472
Rye and oats feed,	11.03	3.24	21.00	1.914
H. O. horse feed,	10.97	3.26	21.25	1.937
Quaker dairy feed,	10.94	2.88	18.00	1.828
Wheat and corn feeds,	10.92	2.90	18.00	1.645
Cerealine feeds,	10.84	8.68	18.00	1.660
Corn bran,	10.75	10.37	17.33	1.612
Hominy chop,	10.75	8.59	18.50	1.721
Corn, oats and barley (American Cereal Co.) ,	10.47	4.57	20.00	1.911
Rye chop,	10.29	1.77	26.00	2.527
Rye and corn,	10.19	3.47	20.67	2.028
Corn, oats and rye,	9.95	2.40	23.11	2.333
Corn, oats and barley (average of all),	9.44	4.02	20.33	2.154
Corn chop,	9.06	4.03	20.17	2.226
Corn meal,	8.87	4.66	19.82	2.234
Corn and oats feed (in general),	8.82	4.27	19.63	2.226
Victor corn and oat feed,	8.04	2.59	18.00	2.289
Sugar feed,*	7.94	7.40	16.00	2.015
Corn-and-cob chop,	7.40	2.44	16.10	2.178
Crescent oat feed,	6.82	3.25	14.75	2.148
Friends' consolidated dairy food,*	6.31	3.08	16.00	2.536
Cereal Feed (American Cereal Co.),*	4.06	1.55	16.00	3.941

* One sample only.

In some of the cases included in the foregoing table, the analytical results and the prices are derived from too small a number of samples and quotations to afford a perfectly representative figure; but in the case of goods made on a large scale by manufacturers whose work is subject to chemical check, even a single analysis should approximate closely to the average composition.

The foods may therefore be divided broadly into classes as follows:

I. Cotton-seed meal, containing over 40 per cent. of protein with a unit of protein requiring an expenditure of about 62 cents.

II. Buckwheat middlings and linseed meal, 30 to 35 per cent. of protein; expenditure per unit of protein, 58 to 84 cents.

III. Malt sprouts, gluten feed and germ-oil cake, 20 to 25 per cent. of protein; expenditure per unit of protein, 70 cents to \$1.00.

IV. Wheat offal of various sorts, H. O. Dairy Feed and Sucrene Dairy Feed, 14 to 20 per cent. of protein; expenditure per unit of protein, \$1.02 to \$1.90.

V. Corn meal, corn bran and similar corn by-products, rye chop, oats chop and certain mixed cereal feeds, about 9 to 13 per cent. protein; expenditure per unit of protein, \$1.10 to \$2.53.

VI. Corn-and-cob chop, sugar feed, oat hulls and feeding-stuffs largely composed thereof, 4 to 9 per cent. of protein; expenditures per unit of protein, \$2.01 to \$3.94.

It is difficult to see how a farmer already well supplied with starchy foods and abundance of good roughage can afford to buy the foods of class VI, which are not only poorer in protein than the grain foods he already has and are less digestible as a class than corn meal; nor if he needs roughage, how he can afford to pay for fine ground mill foods when corn stover of fair quality can be bought for a lower price.

Class V contains, in addition to good foods diluted with oat hulls, many standard grain foods; they are chiefly valuable as sources of starch, and, where protein is the chief thing sought, are too expensive to buy for general feeding purposes.

It is believed that while this classification does not take into account all the items which must be considered in estimating the real cost of a single food constituent, it may prove helpful in reaching safe conclusions in many cases.

COMMERCIAL FEEDING STUFFS IN PENNSYLVANIA AS COMPARED WITH THOSE IN NEIGHBORING STATES.

For several years past, a number of the New England and Middle States have made systematic surveys of the feeding-stuffs markets of their respective territories and published the results; in some States, laws regulating the trade in such commodities, requiring some guaranty of composition and establishing a chemical control, have been enacted. Under such conditions, it would be expected that dealers would more uniformly handle articles of prime quality and fully up to their guaranteed value, than in States where such regulations and control are not in force.

The following comparative table showing the composition of some of the principal commercial feeds as sold in this State and in the New England States where various forms of control are maintained, gives ground for serious reflection on the part of the average buyer of these goods in Pennsylvania. The New England figures are obtained from a compilation of the analyses from May, 1898, to January 1, 1900. (Conn. Sta., Bulletin 130, p. 8.)

Comparative Composition of Feeding Stuffs in Different States.

	Number of samples.	Protein.	Fat.
Cotton-seed meal:			
Pennsylvania,	8	44.40	10.10
New England,	205	45.40	11.12
Linseed meal:			
Old process:			
Pennsylvania,	25	33.32	5.98
New England,	25	35.70	7.20
New process:			
Pennsylvania,	3	34.25	2.63
New England,	31	38.20	2.40
Wheat bran:			
Winter wheat:			
Pennsylvania,	5	15.19	4.26
New England,	45	15.50	4.40
Spring wheat:			
Pennsylvania,	9	14.84	4.65
New England,	53	16.10	4.90
All brans analyzed:			
Pennsylvania,	39	15.30	4.48
New England,	120	15.80	4.70
Wheat middlings:			
Pennsylvania,	41	16.05	4.60
New England,	135	17.00	5.00
Mixed wheat feeds:			
Pennsylvania,	3	14.21	3.90
New England,	219	16.60	4.70
Red dog flour:			
Pennsylvania,	4	19.14	4.87
New England,	9	19.30	4.40
Corn meal:			
Pennsylvania,	15	8.87	4.66
New England,	17	9.50	4.00
Gluten feed:			
Pennsylvania,	12	24.72	2.84
New England,	69	29.68	3.74
Oat feeds:			
Crescent:			
Pennsylvania,	2	6.72	3.25
New England,	3	7.90	3.30
Others:			
Pennsylvania,	6	6.69	2.71
New England,	16	9.30	4.20
Corn-and-oat feeds:			
Victor (Am. Cereal Co.):			
Pennsylvania,	3	8.05	3.59
New England,	26	9.20	3.90
Others:			
Pennsylvania,	22	9.02	4.30
New England,	29	9.44	3.76
Quaker dairy feed (Amer. Cereal Co.):			
Pennsylvania,	2	10.94	2.88
New England,	5	12.80	2.9
Corn, oats and barley feed (Am. Cereal Co.):			
Pennsylvania,	2	10.47	4.57
New England,	6	11.9	4.5
H. O. dairy feed:			
Pennsylvania,	2	16.72	3.39
New England,	20	19.0	4.4
H. O. horse feed:			
Pennsylvania,	2	10.97	3.26
New England,	18	12.4	4.2

Commercial Feeding Stuffs Control.

The data presented in the previous pages exhibit a wide variability of composition in goods of this class selling under the same brand; the existence on the Pennsylvania market without accompanying guarantee, of large quantities of mixed feeds from whose names and appearance no adequate notion of their composition can be formed; a wide-spread use of almost valueless materials in commercial mixtures; considerable misbranding and occasional glaring adulteration. Furthermore, the average quality of the feeding stuffs sold in States that have for several years had cattle food control laws in operation, appears to be considerably superior to the quality of the goods sold under the same name in Pennsylvania.

It is believed that the preliminary comparison of the commercial cattle foods of Pennsylvania and New England made on the basis of the foregoing analyses and presented in the Preliminary Report of the Secretary of Agriculture, 1900, pp. 47-8, supplied to the Legislature clear proof of the need for the Pennsylvania control law enacted during the present year.

Cattle food control legislation is very recent in America. The Maine and Massachusetts laws were enacted in 1897, those of Connecticut, New York and Rhode Island in 1899, followed by New Jersey and Vermont in 1900. For the purpose of affording those interested in such legislation an opportunity for the comparative study of the Pennsylvania law, the laws of the States above named are presented in the Appendix.

WEIGHTS OF FEEDING STUFFS.

For convenience of reference by those who measure instead of weigh their stable feeds, a statement of quart weights as compiled by Maj. H. E. Alvord, Chief of the Dairy Division, U. S. Dept. of Agriculture, and by Mr. H. G. Manchester (Conn. Station Bulletin No. 133, p. 13), are given below. Where differences are observed, they may fairly be attributed to a difference in the mechanical conditions of the material:

	Alvord, pounds.	Manchester, pounds.
Corn, cracked,	1.75	1.5
Corn meal,	1.43	1.3
Corn-and-cob meal,	1.38	1.3
Cotton-seed meal, old process,	1.56	1.3
Gluten feed,	1.50	1.7
Gluten meal,		0.7
H. O. dairy feed,		1.1
Linseed meal, old process,	1.00	1.2
Oats, whole, .....	.75	0.6
Oats, ground,		0.7
Rye bran,		
Victor corn and oat feed,	1.83	
Wheat, whole, .....	.63	.50
Wheat bran, coarse, .....		.80
Wheat middlings, coarse,	1.13	1.1
Wheat middlings, fine, .....		.60
Wheat feed, mixed,		

COMPOSITION OF FEEDING STUFFS.

Giving the Maximum, Minimum and Average for Each Ingredient.

From Farm Bulletin No. 22 of the Department of Agriculture, Washington, D. C.

The figures given do not represent the results of single analyses, but are the highest and lowest results which have been found in the case of each ingredient. *They are given to show the limits within which each ingredient has been found to vary.*

Composition of Feeding Stuffs.

	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Number of analyses.
GREEN FODDER.							
Corn fodder:*							
Flint varieties—	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	
Minimum,	51.1	0.7	0.6	2.1	4.3	0.3	.....
Maximum,	90.8	1.8	4.0	11.4	36.3	1.3	.....
Average,	79.8	1.1	2.0	4.3	12.1	0.7	40
Flint varieties cut after kernels had glazed—							
Minimum,	69.7	0.9	1.5	3.0	10.0	0.6	.....
Maximum,	83.7	1.7	2.7	6.1	19.7	1.3	.....
Average,	77.1	1.1	2.1	4.3	14.6	0.8	10
Dent varieties—							
Minimum,	59.5	0.6	0.5	2.0	3.0	0.1	.....
Maximum,	93.6	2.5	3.8	11.0	27.0	1.6	.....
Average,	79.0	1.2	1.7	5.6	12.0	0.5	63
Dent varieties cut after kernels had glazed—							
Minimum,	59.5	1.0	1.0	5.4	11.6	0.4	.....
Maximum,	80.7	2.2	3.3	8.5	27.0	1.6	.....
Average,	73.4	1.5	2.0	6.7	15.5	0.9	7

*Corn fodder is the entire plant, usually a thickly planted crop. Corn stover is what is left after the ears are harvested.

Composition of Feeding Stuffs.—Continued.

	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Number of analyses.
GREEN FODDER—Continued.							
Sweet varieties—	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	
Minimum,	69.3	0.8	0.9	1.9	3.2	0.1	.....
Maximum,	92.9	2.6	2.7	8.5	19.4	1.0	.....
Average,	79.1	1.3	1.9	4.4	12.8	0.5	21
All varieties—							
Minimum,	51.5	0.6	0.5	1.9	3.0	0.1	.....
Maximum,	93.6	2.6	4.0	11.4	36.3	1.6	.....
Average,	79.3	1.2	1.8	5.0	12.2	0.5	126
Leaves and husks, cut green—							
Minimum,	57.9	2.1	1.8	6.6	16.7	1.0	.....
Maximum,	71.3	4.4	2.4	12.5	22.2	1.3	.....
Average,	66.2	2.9	2.1	8.7	19.0	1.1	4
Stripped stalks, cut green—							
Minimum,	74.5	0.6	0.4	6.7	14.2	0.4	.....
Maximum,	77.4	0.8	0.6	8.8	16.0	0.6	.....
Average,	76.1	0.7	0.5	7.3	14.9	0.5	4
Rye fodder:							
Minimum,	74.4	1.3	2.3	4.7	4.9	0.2	.....
Maximum,	84.3	2.4	3.0	14.9	12.4	0.7	.....
Average,	76.6	1.8	2.6	11.6	6.8	0.6	7
Oat fodder:							
Minimum,	31.3	1.5	1.5	7.1	10.8	0.4	.....
Maximum,	78.6	4.2	6.1	16.8	39.8	3.0	.....
Average,	62.2	2.5	3.4	11.2	19.3	1.4	6
Redtop,* in bloom:							
Minimum,	51.5	1.7	2.0	8.0	11.7	0.6	.....
Maximum,	76.2	2.9	4.3	15.7	21.9	1.1	.....
Average,	65.3	2.3	2.8	11.0	17.7	0.9	5
Tall oat grass, † in bloom:							
Minimum,	62.3	1.6	1.7	9.2	13.0	0.6	.....
Maximum,	73.5	3.0	3.3	9.7	20.7	1.5	.....
Average,	69.5	2.0	2.4	9.4	15.8	0.9	3
Orchard grass, in bloom:							
Minimum,	66.9	1.6	1.9	5.8	9.9	0.7	.....
Maximum,	77.3	2.9	4.1	11.1	16.6	1.3	.....
Average,	73.0	2.0	2.6	8.2	13.3	0.9	4
Meadow fescue, in bloom:							
Minimum,	67.6	1.6	1.8	10.2	12.5	0.7	.....
Maximum,	73.2	2.0	2.7	11.3	15.7	1.1	.....
Average,	69.9	1.8	2.4	10.8	14.3	0.8	4
Italian rye grass, coming into bloom:							
Minimum,	69.6	2.1	2.6	5.5	11.5	1.1	.....
Maximum,	76.6	2.8	3.8	7.5	15.4	1.6	.....
Average,	73.2	2.5	3.1	6.8	13.3	1.3	24
Timothy, ‡ at different stages:							
Minimum,	47.0	1.4	1.3	5.1	10.1	0.6	.....
Maximum,	78.7	3.2	3.8	19.4	28.6	2.0	.....
Average,	61.6	2.1	3.1	11.8	20.2	1.2	56
Kentucky blue grass, § at different stages:							
Minimum,	51.7	1.6	2.4	3.8	6.5	0.8	.....
Maximum,	32.5	4.8	7.2	13.4	25.6	1.9	.....
Average,	65.1	2.8	4.1	9.1	17.6	1.3	13

*Herd's grass of Pennsylvania.

†Meadow oat grass.

‡Herd's grass of New England and New York.

§June grass.

Composition of Feeding Stuffs.—Continued.

	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Number of analyses.
GREEN FODDER—Continued.							
Hungarian grass:	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	
Minimum,	62.7	1.9	2.8	7.6	9.1	0.5	.....
Maximum,	78.3	2.2	3.2	10.8	20.1	1.1	.....
Average,	71.1	1.7	3.1	9.2	14.2	0.7	14
Red clover, at different stages:							
Minimum,	47.1	0.9	1.7	1.8	3.5	0.3	.....
Maximum,	91.8	4.0	7.1	14.7	25.8	1.8	.....
Average,	70.8	2.1	4.4	8.1	13.5	1.1	43
Alsike clover,* in bloom:							
Minimum,	72.3	1.9	3.6	5.3	10.8	0.6	.....
Maximum,	77.3	2.1	4.2	9.4	11.5	1.2	.....
Average,	74.8	2.0	3.9	7.4	11.0	0.9	4
Crimson clover:							
Minimum,	78.4	1.4	2.7	3.5	7.0	0.6	.....
Maximum,	84.6	2.0	3.5	6.3	9.7	0.8	.....
Average,	80.9	1.7	3.1	5.2	8.4	0.7	3
Alfalfa,† at different stages:							
Minimum,	49.3	1.8	3.5	2.5	10.8	0.6	.....
Maximum,	82.0	5.1	7.7	14.8	11.5	1.2	.....
Average,	71.8	2.7	4.8	7.4	12.3	1.0	23
Serradella, at different stages:							
Minimum,	65.6	1.8	2.1	2.6	3.9	0.4	.....
Maximum,	84.6	5.8	3.0	7.8	17.1	1.8	.....
Average,	79.5	3.2	2.7	5.4	8.6	0.7	9
Cowper:							
Minimum,	72.8	1.2	1.5	1.7	1.8	1.2	.....
Maximum,	93.1	2.7	3.5	15.2	12.9	0.6	.....
Average,	83.6	1.7	2.4	4.8	7.1	0.4	10
Soja bean:							
Minimum,	63.3	1.8	2.2	4.8	5.8	0.5	.....
Maximum,	81.5	5.1	5.9	9.7	16.0	1.6	.....
Average,	75.1	2.6	4.0	6.7	10.6	1.0	27
Horse bean:							
Average,	84.2	1.2	2.8	4.9	6.5	0.4	2
Flat pea (<i>Lathyrus sylvestris</i>):							
Average,	66.7	2.9	8.7	7.9	12.2	1.6	2
Rape:							
Average,	84.5	2.0	2.3	2.6	8.4	0.5	2
SILAGE.							
Corn silage:							
Minimum,	62.4	0.3	0.7	3.0	5.1	0.2	.....
Maximum,	87.7	3.3	3.6	10.5	24.2	2.0	.....
Average,	79.1	1.4	1.7	6.0	11.0	0.8	99
Sorghum silage:							
Minimum,	71.9	0.8	0.6	5.9	13.8	0.1	.....
Maximum,	78.0	1.2	0.9	6.8	19.0	0.5	.....
Average,	76.1	1.1	0.8	6.4	15.3	0.3	6
Red clover silage:							
Minimum,	61.4	1.9	3.0	5.1	8.1	0.9	.....
Maximum,	78.6	3.0	5.9	13.9	14.3	1.6	.....
Average,	72.0	2.6	4.2	8.4	11.6	1.2	.....
Soja bean silage:							
Average,	74.2	2.8	4.1	9.7	6.9	2.2	1

*Swedish clover.

†Lucern.

Composition of Feeding Stuffs.—Continued.

	Water.	Ash.	Protein	Fiber.	Nitrogen-free extract.	Fat.	Number of analyses.
GREEN FODDER—Continued.							
Cowpea vine silage:	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	
Average,	79.3	2.9	2.7	6.0	7.6	1.5	2
Field pea vine silage:							
Average,	50.1	3.5	5.9	13.0	26.0	1.6	1
Silage of mixture of cowpea vines and soja bean vines, average,	69.8	4.5	3.8	9.5	11.1	1.3	1
HAY AND DRY COARSE FODDER.							
Corn fodder,* field cured:							
Minimum,	22.9	1.5	2.7	7.5	20.6	0.6	.....
Maximum,	60.2	5.5	6.9	24.7	47.8	2.5	....
Average,	42.2	2.7	4.5	14.3	34.7	1.6	35
Corn leaves, field cured:							
Minimum,	14.8	4.3	4.5	17.4	27.3	0.8	.....
Maximum,	44.0	7.4	8.3	27.4	41.4	2.2	.....
Average,	30.0	5.5	6.0	21.4	35.7	1.4	17
Corn husks, field cured:							
Minimum,	26.7	0.6	1.3	6.8	14.3	0.5	.....
Maximum,	76.6	2.3	3.2	23.6	43.6	1.0	.....
Average,	50.9	1.8	2.5	15.8	28.3	0.7	16
Corn stalks, field cured:							
Minimum,	51.3	0.6	1.2	6.9	11.2	0.3	.....
Maximum,	78.5	2.0	3.0	16.8	26.0	1.0	.....
Average,	68.4	1.2	1.9	11.0	17.0	0.5	15
Corn stover, † field cured:							
Minimum,	15.4	1.7	1.9	14.1	23.3	0.7	.....
Maximum,	57.4	7.0	8.3	32.2	53.3	2.2	.....
Average,	40.5	3.4	3.8	19.7	31.5	1.1	60
Hay from:							
Redtop,‡ cut at different stages—							
Minimum,	6.8	3.8	5.9	24.0	44.8	1.4	.....
Maximum,	11.6	7.0	10.4	31.8	50.4	3.2	.....
Average,	8.9	5.2	7.9	28.6	47.5	1.9	9
Redtop, cut in bloom—							
Minimum,	6.8	4.8	7.8	24.0	46.8	1.5	.....
Maximum,	11.6	6.5	10.4	31.8	47.8	2.3	.....
Average,	8.7	4.9	8.0	29.9	46.4	2.1	3
Orchard grass—							
Minimum,	6.5	5.0	6.6	28.9	32.9	1.7	.....
Maximum,	13.6	7.9	10.4	38.3	48.6	3.3	.....
Average,	9.9	6.0	8.1	32.4	41.0	2.6	10
Timothy,§ all analyses—							
Minimum,	6.1	2.5	3.8	22.3	34.3	1.0	.....
Maximum,	28.9	6.3	9.8	38.5	58.5	4.0	.....
Average,	13.2	4.4	5.9	29.0	45.0	2.5	68
Timothy, cut in full bloom—							
Minimum,	7.0	2.5	5.0	22.2	34.4	2.0	.....
Maximum,	28.9	6.0	7.5	37.1	48.5	4.0	.....
Average,	15.0	4.5	6.0	29.6	41.9	3.0	11

*Entire plant.

†What is left after the ears are harvested.

‡Herd's grass of Pennsylvania.

§Herd's grass of New England and New York

Composition of Feeding Stuffs.—Continued.

	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Number of analyses.
HAY AND DRY COARSE FODDER—Continued.							
Hay from:	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	
Timothy cut soon after bloom—							
Minimum,	7.8	3.5	4.6	25.7	37.0	1.7	.....
Maximum,	21.6	5.4	8.1	33.4	51.0	3.6	.....
Average,	14.2	4.4	5.7	28.1	44.6	3.0	11
Timothy cut when nearly ripe—							
Minimum,	7.0	2.7	4.3	24.8	38.0	1.0	.....
Maximum,	22.7	5.1	6.0	38.5	49.1	2.8	.....
Average,	14.1	3.9	5.0	31.1	43.7	2.2	12
Minimum,	14.3	4.5	5.3	17.7	31.8	2.0	.....
Maximum,	32.8	7.8	12.9	26.8	51.1	4.2	.....
Average,	21.2	6.3	7.8	23.0	37.8	3.9	10
Cut when seed was in milk—							
Minimum,	22.5	5.6	6.0	23.9	33.2	3.4	.....
Maximum,	26.5	7.6	6.6	24.9	35.4	4.1	.....
Average,	24.4	7.0	6.2	24.5	24.2	3.6	4
Cut when seed was ripe—							
Minimum,	23.7	5.1	5.3	20.4	33.6	2.8	.....
Maximum,	32.8	7.8	6.0	25.7	33.7	3.2	.....
Average,	27.8	6.4	5.8	23.8	33.2	3.0	4
Hungarian grass—							
Minimum,	4.9	5.0	4.7	23.6	44.4	1.5	.....
Maximum,	9.5	7.5	13.3	36.3	53.0	3.5	.....
Average,	7.7	6.0	7.5	27.7	49.0	2.1	18
Meadow fescue—							
Minimum,	7.4	5.5	4.5	20.8	28.5	1.6	.....
Maximum,	32.5	7.8	11.8	31.9	45.5	3.5	.....
Average,	20.0	6.8	7.0	25.9	38.4	2.7	9
Italian rye grass—							
Minimum,	7.4	6.1	5.7	28.4	39.6	1.3	.....
Maximum,	9.3	7.9	8.8	33.9	48.9	1.9	.....
Average,	8.5	6.9	7.5	30.5	45.0	1.7	4
Mixed grasses—							
Minimum,	6.5	2.1	4.8	21.0	33.4	1.3	.....
Maximum,	33.4	6.9	12.1	38.4	50.8	4.9	.....
Average,	15.3	5.5	7.4	27.2	41.1	2.5	126
Hay from:							
Rowen (mixed)*							
Minimum,	8.2	5.1	9.6	20.1	33.6	2.2	.....
Maximum,	24.4	7.2	14.8	20.0	44.3	4.5	.....
Average,	16.6	6.8	11.6	22.5	39.4	3.1	23
Mixed grasses and clovers—							
Minimum,	8.2	3.9	5.5	19.7	31.8	1.5	.....
Maximum,	15.9	9.6	14.4	35.1	48.9	3.1	.....
Average,	12.9	5.5	10.1	27.6	41.3	2.6	17
Swamp hay—							
Minimum,	7.8	3.3	5.0	19.4	39.9	0.8	.....
Maximum,	17.9	12.1	8.8	31.6	51.7	3.6	.....
Average,	11.6	6.7	7.2	26.6	45.9	2.0	8
Salt marsh—							
Minimum,	7.8	5.4	4.0	25.1	34.1	1.6	.....
Maximum,	18.6	11.8	7.8	33.8	54.3	3.1	.....
Average,	10.4	7.7	5.5	30.0	44.1	2.4	10

*Second cut.

Composition of Feeding Stuffs.—Continued.

	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Number of analyses.
HAY AND DRY COARSE FODDER—Continued.							
Red clover—	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	
Minimum,	6.0	3.9	10.0	15.6	27.3	1.5	.....
Maximum,	31.3	8.3	20.2	35.7	52.2	5.9	.....
Average,	15.3	6.2	12.3	24.8	38.1	3.3	38
Red clover in bloom—							
Minimum,	6.0	5.6	10.8	17.9	27.3	2.5	.....
Maximum,	31.3	8.3	15.4	28.1	41.3	5.9	.....
Average,	20.8	6.6	12.4	21.9	33.8	4.5	6
Alsike clover—							
Minimum,	5.3	6.1	9.2	19.7	35.6	1.6	.....
Maximum,	13.9	12.3	16.1	29.5	45.9	4.2	.....
Average,	9.7	8.3	12.8	25.6	40.7	2.9	9
White clover—							
Minimum,	6.1	4.5	13.9	20.3	33.4	1.7	.....
Maximum,	13.5	13.8	20.0	30.3	47.3	5.8	.....
Average,	9.7	8.3	15.7	24.1	39.3	2.9	7
Crimson clover—							
Minimum,	5.9	7.4	13.6	20.1	29.3	1.5	.....
Maximum,	13.4	13.0	16.1	34.9	42.6	4.8	.....
Average,	9.6	8.6	15.2	27.2	36.6	2.8	7
Japan clover—							
Average,	11.0	8.5	13.8	24.0	39.0	3.7	2
Vetch—							
Minimum,	8.3	7.1	13.1	19.7	26.5	1.6	.....
Maximum,	15.8	11.6	23.1	28.1	40.2	3.0	.....
Average,	11.3	7.9	17.0	25.4	36.1	2.3	5
Serradella—							
Minimum,	7.2	5.4	13.9	19.4	40.5	2.2	.....
Maximum,	11.7	10.3	16.6	22.9	46.0	2.9	.....
Average,	9.2	7.2	15.2	21.6	44.2	2.6	2
Alfalfa*—							
Minimum,	4.6	3.1	10.2	14.0	35.1	1.1	.....
Maximum,	16.0	10.4	23.3	33.0	53.6	3.8	.....
Average,	8.4	7.4	14.3	25.0	42.7	2.2	21
Cowpea—							
Minimum,	7.6	3.2	13.6	16.4	39.4	1.1	.....
Maximum,	14.0	10.2	20.3	25.0	49.5	3.7	.....
Average,	10.7	7.5	16.6	20.1	42.2	2.2	8
Soja bean—							
Minimum,	6.1	4.8	14.0	17.3	31.8	2.4	.....
Maximum,	20.1	8.9	18.1	32.3	41.0	7.5	.....
Average,	11.3	7.2	15.4	22.3	38.6	5.2	6
Flat pea (<i>Lathyrus sylvestris</i>)—							
Minimum,	6.3	6.5	17.6	18.5	27.7	1.6	.....
Maximum,	10.0	8.6	27.9	32.7	34.0	4.6	.....
Average,	8.4	7.9	22.9	26.2	31.4	3.2	5
Peanut vines (without nuts)—							
Minimum,	6.3	7.3	9.1	18.3	33.1	1.7	.....
Maximum,	7.8	15.7	11.7	33.3	50.4	5.8	.....
Average,	7.6	10.8	10.7	23.6	42.7	4.6	6
Soja bean straw:							
Minimum,	5.7	3.9	4.0	34.0	35.3	0.8	.....
Maximum,	14.0	4.9	4.9	49.6	43.3	3.2	.....
Average,	10.1	5.8	4.6	40.4	37.4	1.7	4

*Lucern.

Composition of Feeding Stuffs.—Continued.

	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Number of analyses.
HAY AND DRY COARSE FODDER—Continued.							
Horse-bean straw:	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	
Average,	9.2	8.7	8.8	37.6	34.3	1.4	1
Wheat straw:							
Minimum,	6.5	3.0	2.9	34.3	31.0	0.8	.....
Maximum,	17.9	7.0	5.0	42.7	50.6	1.8	.....
Average,	9.6	4.2	3.4	38.1	43.4	1.3	7
Rye straw:							
Minimum,	6.3	2.8	2.2	32.7	41.0	1.0	.....
Maximum,	9.7	3.4	3.6	43.3	52.9	1.6	.....
Average,	7.1	3.2	3.0	38.9	46.6	1.2	7
Oat straw:							
Minimum,	6.5	3.7	2.7	31.8	33.5	1.7	.....
Maximum,	11.4	6.7	6.9	45.1	46.6	3.2	.....
Average,	9.2	5.1	4.0	37.0	42.4	2.3	12
Buckwheat straw:							
Minimum,	9.0	4.9	3.3	37.2	32.1	0.7	.....
Maximum,	10.4	6.5	7.8	46.8	38.9	1.7	.....
Average,	9.9	5.5	5.2	43.0	35.1	1.3	3
ROOTS AND TUBERS.							
Potatoes:							
Minimum,	75.4	0.8	1.1	0.3	14.1	.....	.....
Maximum,	82.2	1.2	3.0	0.9	20.4	0.1	.....
Average,	78.9	1.0	2.1	0.6	17.3	0.1	12
Sweet potatoes:							
Minimum,	66.0	0.7	0.5	0.6	18.0	0.3	.....
Maximum,	74.4	1.3	3.6	2.5	29.7	0.6	.....
Average,	71.1	1.0	1.5	1.3	24.7	0.4	6
Red beets:							
Minimum,	85.8	0.7	1.1	0.6	3.8	0.1	.....
Maximum,	92.2	1.6	1.8	1.7	11.3	0.3	.....
Average,	88.5	1.0	1.5	0.9	8.0	0.1	9
Sugar beets:							
Minimum,	85.0	0.4	1.1	0.6	5.7	0.1	.....
Maximum,	90.8	1.2	3.2	1.3	13.6	0.2	.....
Average,	86.5	0.9	1.8	0.9	9.8	0.1	19
Mangel-wurzels:							
Minimum,	86.9	0.8	1.0	0.6	2.4	0.1	.....
Maximum,	94.4	1.4	1.9	1.3	8.7	0.5	.....
Average,	90.9	1.1	1.4	0.9	5.5	0.2	9
Turnips:							
Minimum,	87.2	0.7	0.8	0.8	4.2	0.1	.....
Maximum,	92.4	1.0	1.4	1.4	8.8	0.2	.....
Average,	90.5	0.8	1.1	1.2	6.2	0.2	3
Rutabagas:							
Minimum,	87.1	1.0	1.0	1.1	5.1	0.1	.....
Maximum,	91.8	1.4	1.3	1.4	9.1	0.3	.....
Average,	88.6	1.2	1.2	1.3	7.5	0.2	4
Carrots:							
Minimum,	86.5	1.6	0.8	0.9	5.1	0.2	.....
Maximum,	91.1	1.3	2.0	2.3	10.4	0.7	.....
Average,	88.6	1.0	1.1	1.3	7.6	0.4	8
Artichokes:							
Average,	79.5	1.0	2.6	0.8	15.9	0.2	2

Composition of Feeding Stuffs.—Continued.

	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Number of analyses.
GRAINS AND OTHER SEEDS.							
Corn kernels:	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	
Dent, all analyses—							
Minimum,	6.2	1.0	7.5	0.9	65.9	3.1	.....
Maximum,	19.4	2.6	11.8	4.8	75.7	7.5	.....
Average,	10.6	1.5	10.3	2.2	70.4	5.0	86
Flint, all analyses—							
Minimum,	4.5	1.0	7.0	0.7	65.0	3.4	.....
Maximum,	19.6	1.9	13.7	2.9	76.7	7.1	.....
Average,	11.3	1.4	10.5	1.7	70.1	5.0	68
Sweet, all analyses—							
Minimum,	6.0	1.4	9.5	1.5	61.8	3.8	.....
Maximum,	10.9	2.4	15.3	5.2	72.4	9.3	.....
Average,	8.8	1.9	11.6	2.8	66.8	8.1	26
Pop varieties—							
Minimum,	8.6	1.2	9.7	1.2	68.4	4.2	.....
Maximum,	11.8	1.7	13.1	2.3	71.1	6.0	.....
Average,	10.7	1.5	11.2	1.8	69.6	5.2	4
Soft varieties—							
Minimum,	6.1	1.4	8.8	1.3	66.0	5.0	.....
Maximum,	14.1	1.9	14.6	3.3	75.5	5.7	.....
Average,	9.3	1.6	11.4	2.0	70.2	5.5	5
All varieties and analyses—							
Minimum,	4.5	1.0	7.0	0.7	61.8	3.1	.....
Maximum,	20.7	2.6	15.3	5.2	76.7	9.3	.....
Average,	10.9	1.5	10.5	2.1	69.6	5.4	203
Sorghum seed:							
Minimum,	9.3	1.4	7.7	1.5	59.0	2.1	.....
Maximum,	16.8	4.3	11.3	8.7	73.6	4.6	.....
Average,	12.8	2.1	9.1	2.6	69.8	3.6	10
Barley:							
Minimum,	7.2	1.8	8.6	1.3	66.7	1.5	.....
Maximum,	12.6	3.2	15.7	4.2	73.9	3.2	.....
Average,	10.9	2.4	12.4	2.7	69.8	1.8	10
Oats:							
Minimum,	8.9	2.0	8.0	1.5	53.5	3.4	.....
Maximum,	13.5	4.0	14.4	12.9	66.9	5.8	.....
Average,	11.0	3.0	11.8	9.5	59.7	5.0	30
Rye:							
Minimum,	8.7	1.8	9.5	1.4	71.2	1.4	.....
Maximum,	13.2	1.9	12.1	2.1	73.9	2.1	.....
Average,	11.6	1.9	10.6	1.7	72.5	1.7	6
Wheat, spring varieties:							
Minimum,	8.1	1.5	8.4	1.3	66.1	1.8	.....
Maximum,	13.4	2.6	15.4	2.3	74.9	2.6	.....
Average,	10.4	1.9	12.5	1.8	71.2	2.2	13
Wheat, winter varieties, all analyses:							
Minimum,	7.1	0.8	8.1	0.4	66.7	1.3	.....
Maximum,	14.0	3.6	16.6	2.9	77.7	3.9	.....
Average,	10.5	1.8	11.8	1.8	72.0	2.1	262
Wheat, all varieties:							
Minimum,	7.1	0.8	8.1	0.4	64.8	1.3	.....
Maximum,	14.0	3.6	17.2	3.1	77.7	1.3	.....
Average,	10.5	1.8	11.9	1.8	71.9	2.1	310
Rice:							
Minimum,	11.4	0.3	5.9	0.1	77.5	0.3	.....
Maximum,	14.0	0.5	8.6	0.4	80.6	0.6	.....
Average,	12.4	0.4	7.4	0.2	79.2	0.4	10

Composition of Feeding Stuffs.—Continued.

	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Number of analyses.
GRAINS AND OTHER SEED—Continued.							
Buckwheat:	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	
Minimum,	10.9	1.6	8.6	7.8	62.6	2.2	.....
Maximum,	14.8	2.3	11.0	9.4	65.4	2.4	.....
Average,	12.6	2.3	10.0	8.7	64.5	2.2	8
Sunflower seed (whole):							
Minimum,	8.5	2.1	15.8	29.5	22.0	20.9	.....
Maximum,	8.8	3.2	16.7	30.3	27.7	21.5	.....
Average,	8.6	2.6	16.3	29.9	21.4	21.2	2
Cotton seed, whole (with hulls):							
Minimum,	7.0	2.9	14.5	20.3	17.3	18.9	.....
Maximum,	17.5	4.5	21.7	28.7	29.1	21.6	.....
Average,	10.3	3.5	18.4	23.2	24.7	19.9	5
Cotton seed kernels (without hulls):							
Minimum,	6.0	4.0	29.3	3.1	15.8	36.5	.....
Maximum,	6.3	5.4	33.1	4.4	19.5	36.6	.....
Average,	6.2	4.7	31.2	3.7	17.6	36.6	2
Cotton seed, whole, (roasted):							
Minimum,	2.9	2.3	16.1	16.8	21.1	22.5	.....
Maximum,	9.3	8.7	17.6	24.0	25.8	32.7	.....
Average,	6.1	5.5	16.8	20.4	23.5	27.7	2
Peanut kernel (without hulls):							
Minimum,	4.9	1.9	23.2	2.0	12.7	35.0	.....
Maximum,	13.2	3.8	31.4	18.4	19.1	47.4	.....
Average,	7.5	2.4	27.9	7.0	15.6	39.6	7
Horse bean,	11.3	3.8	26.6	7.2	50.1	1.0	1
Soja bean:							
Minimum,	5.9	3.1	26.3	3.4	26.2	12.3	.....
Maximum,	19.3	5.4	40.2	6.1	32.8	19.0	.....
Average,	10.8	4.7	34.0	4.8	28.8	16.9	8
Cowpea:							
Minimum,	10.0	2.9	19.3	2.5	50.5	1.3	.....
Maximum,	20.9	3.4	23.4	5.0	62.0	1.6	.....
Average,	14.8	3.2	20.8	4.1	55.7	1.4	5
MILL PRODUCTS.							
Corn meal:							
Minimum,	8.0	0.9	7.1	0.5	60.4	2.0	.....
Maximum,	27.4	4.1	13.9	3.1	74.0	5.1	.....
Average,	15.0	1.4	9.2	1.9	68.7	3.8	77
Corn and cob meal:							
Minimum,	9.5	1.2	5.8	4.7	56.8	2.5	.....
Maximum,	26.3	1.9	12.2	9.4	60.7	4.7	.....
Average,	15.1	1.5	8.5	6.6	64.8	3.5	7
Oat meal:							
Minimum,	6.2	1.8	12.9	0.6	66.6	6.1	.....
Maximum,	8.8	2.2	16.3	1.2	69.0	8.8	.....
Average,	7.9	8.0	14.7	0.9	67.4	7.1	6
Barley meal:							
Minimum,	9.9	1.6	9.8	5.9	63.5	1.5	.....
Maximum,	13.6	3.8	12.7	7.0	68.0	3.2	.....
Average,	11.9	2.6	10.5	6.5	66.3	2.2	3
Rye flour:							
Minimum,	12.4	0.6	0.4	6.0	77.6	0.8	.....
Maximum,	13.6	0.8	6.9	0.5	79.1	0.9	.....
Average,	13.1	0.7	6.7	0.4	78.3	0.8	4

Composition of Feeding Stuffs.—Continued.

	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Number of analyses.
MILL PRODUCTS—Continued.							
Wheat flour, all analyses:	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	
Minimum,	8.2	0.3	8.6	0.1	71.5	0.6	.....
Maximum,	13.6	0.7	13.6	1.0	78.5	1.8	.....
Average,	12.4	0.5	10.8	0.2	75.0	1.1	20
Buckwheat flour:							
Minimum,	12.8	0.7	4.2	0.2	71.1	0.7	.....
Maximum,	17.6	1.3	8.1	0.5	79.4	1.8	.....
Average,	14.6	1.0	6.9	0.3	75.8	1.4	4
Ground linseed:							
Minimum,	7.9	3.4	20.3	5.0	25.5	30.3	.....
Maximum,	8.3	6.1	23.0	6.9	30.2	30.5	.....
Average,	8.1	4.7	21.6	7.3	27.9	30.4	2
Pea meal:							
Minimum,	8.9	2.6	19.1	17.1	50.2	0.9	.....
Maximum,	12.1	2.7	21.4	17.7	52.0	1.5	.....
Average,	10.5	2.6	20.2	14.4	15.1	1.2	2
Soja-bean meal,	10.8	45.5	36.7	4.5	27.3	16.2	1
Ground corn and oats, equal parts:							
Minimum,	10.7	1.9	8.4	.....	*70.4	4.0	.....
Maximum,	13.1	2.7	10.4	.....	*73.4	5.0	.....
Average,	11.9	2.2	9.6	.....	*72.0	4.4	6
WASTE PRODUCTS.							
Corn-cob:							
Minimum,	7.2	0.7	1.2	18.2	43.8	0.1	.....
Maximum,	24.8	2.7	3.7	38.3	66.7	0.9	.....
Average,	10.7	1.4	2.4	30.1	54.9	0.5	18
Hominy chops:							
Minimum,	8.1	1.9	7.9	2.5	61.0	4.5	.....
Maximum,	13.5	3.1	11.2	6.7	71.1	11.2	.....
Average,	11.1	2.5	9.8	3.8	64.5	8.3	12
Corn-germ:							
Minimum,	9.4	1.9	9.7	1.9	61.9	5.2	.....
Maximum,	13.0	7.4	9.9	5.8	67.4	11.2	.....
Average,	10.7	4.0	9.8	4.1	64.0	7.4	3
Corn-germ meal:							
Minimum,	6.5	0.8	10.0	7.8	57.4	4.3	.....
Maximum,	9.9	2.6	14.0	13.0	67.0	11.2	.....
Average,	8.1	1.3	11.1	9.9	62.5	7.1	6
Gluten meal:							
Minimum,	6.2	0.5	21.3	0.3	34.0	3.4	.....
Maximum,	12.3	2.0	39.2	7.8	58.5	20.0	.....
Average,	8.8	0.8	29.7	2.2	49.8	8.7	54
Recent analyses—							
Minimum,	6.2	0.5	21.4	0.6	34.0	6.6	.....
Maximum,	11.1	2.0	39.3	7.8	58.4	20.0	.....
Average,	8.2	0.9	29.3	3.3	46.5	11.8	20
Chicago†—							
Average,	10.1	1.1	30.1	1.6	48.7	8.4	6
Buffalo†—							
Average,	8.2	0.8	23.3	6.1	50.4	11.2	5
Cream gluten:							
Minimum,	7.7	0.6	34.1	1.2	35.0	13.6	.....
Maximum,	9.0	0.8	38.2	1.3	41.1	15.8	.....
Average,	8.1	0.7	36.1	1.3	39.0	14.8	3

*Including fiber.

†Included in above average.

Composition of Feeding Stuffs.—Continued.

	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Number of analyses.
WASTE PRODUCTS—Continued.							
Gluten feed:	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	
Minimum,	6.3	0.7	19.5	1.5	44.5	7.0	.....
Maximum,	9.0	1.8	28.3	8.2	58.0	12.6	.....
Average,	7.8	1.1	24.0	5.3	41.2	10.6	11
Buffalo—							
Average,	7.7	1.1	25.0	5.3	49.3	11.6	5
Pope's,	14.0	0.6	33.3	1.6	36.5	14.1	1
Peoria,†	7.5	0.8	19.8	8.2	51.1	12.6	1
Chicago maize feed:							
Minimum,	8.6	0.7	19.3	6.8	49.2	5.6	.....
Maximum,	9.7	1.1	26.9	8.7	56.1	7.9	.....
Average,	9.1	0.9	22.8	7.6	52.7	6.9	3
Glucose feed and glucose refuse:							
Average,	6.5	1.1	20.7	4.5	56.8	10.4	2
Dried starch feed and sugar feed:							
Minimum,	9.2	0.6	17.1	3.1	49.2	7.3	.....
Maximum,	11.7	1.2	22.1	5.6	59.6	11.1	.....
Average,	10.9	0.9	19.7	4.7	54.8	9.0	4
Starch feed, wet:							
Minimum,	62.3	0.1	3.6	1.6	18.7	1.3	.....
Maximum,	72.2	0.6	9.6	4.4	28.9	4.4	.....
Average,	65.4	0.3	6.1	3.1	22.0	3.1	12
Oat feed:							
Minimum,	6.4	3.2	12.6	3.7	56.2	6.1	.....
Maximum,	9.2	4.2	20.0	12.5	63.7	7.8	.....
Average,	7.7	3.7	16.0	6.1	59.4	7.1	4
Barley screenings:							
Minimum,	12.0	3.5	12.1	7.0	61.6	2.6	.....
Maximum,	12.4	3.6	12.5	7.6	62.0	2.9	.....
Average,	12.2	3.6	12.3	7.3	61.8	2.8	2
Malt sprouts:							
Minimum,	7.3	3.8	21.0	9.3	45.5	1.0	.....
Maximum,	12.0	6.7	25.9	12.0	50.3	3.0	.....
Average,	10.2	5.7	23.2	10.7	48.5	1.7	4
Brewers' grains, wet:							
Minimum,	68.6	0.3	4.3	3.1	9.6	0.8	.....
Maximum,	79.4	1.5	6.9	5.6	15.9	2.8	.....
Average,	75.7	1.0	5.4	3.8	12.5	1.6	15
Brewers' grains, dried:							
Minimum,	6.2	3.3	19.3	10.2	46.1	4.2	.....
Maximum,	11.9	3.8	20.3	11.6	56.8	6.5	.....
Average,	8.2	3.6	19.9	11.0	51.7	5.6	3
Grano gluten,	5.8	2.8	31.1	12.0	33.4	14.9	1
Rye bran:							
Minimum,	8.2	2.9	11.5	2.5	59.8	1.7	.....
Maximum,	13.7	4.5	16.8	4.1	67.6	4.9	.....
Average,	11.6	3.6	14.7	3.5	63.8	2.8	7
Wheat bran from spring wheat:							
Minimum,	7.4	4.0	14.3	5.4	51.7	3.6	.....
Maximum,	13.6	6.0	18.1	10.1	58.1	5.0	.....
Average,	11.5	5.4	16.1	8.0	54.5	4.5	10
Wheat bran from winter wheat:							
Minimum,	10.6	5.0	13.9	7.2	50.5	3.5	.....
Maximum,	13.6	6.4	17.8	8.9	56.2	4.5	.....
Average,	12.3	5.9	16.0	8.1	53.7	4.0	7

†Included in above average.

Composition of Feeding Stuffs.—Continued.

	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Rat.	Number of analyses.
WASTE PRODUCTS—Continued.							
Wheat bran, all analyses:	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	
Minimum,	7.4	2.5	12.1	2.4	45.5	1.5	.....
Maximum,	15.8	7.8	18.9	15.5	63.2	7.0	.....
Average,	11.9	5.8	15.4	9.0	53.9	4.0	86
Wheat middlings:							
Minimum,	9.2	1.4	10.1	1.3	53.0	2.1	.....
Maximum,	16.0	6.3	20.0	12.7	70.9	5.9	.....
Average,	12.1	3.3	15.6	4.6	60.4	4.0	32
Wheat shorts:							
Minimum,	4.1	2.0	11.1	6.0	50.0	2.5	.....
Maximum,	15.5	6.2	19.4	10.5	67.0	6.1	.....
Average,	11.8	4.6	14.9	7.4	56.8	4.5	12
Wheat screenings:							
Minimum,	7.8	1.9	8.3	1.7	61.0	2.7	.....
Maximum,	13.6	3.8	16.9	7.5	70.4	3.3	.....
Average,	11.6	2.9	12.5	4.9	65.1	3.0	10
Rice bran:							
Minimum,	8.8	8.4	10.9	2.0	41.9	5.2	.....
Maximum,	10.7	12.4	13.6	17.8	62.3	10.9	.....
Average,	9.7	10.0	12.1	9.5	49.9	8.8	5
Rice hulls:							
Minimum,	7.7	10.5	2.9	30.3	36.0	0.6	.....
Maximum,	8.5	15.1	4.7	38.6	41.6	0.9	.....
Average,	8.2	13.2	3.6	35.7	38.6	0.7	3
Rice polish:							
Minimum,	9.0	2.8	10.9	2.4	45.5	6.5	.....
Maximum,	11.2	11.3	12.9	14.5	63.3	8.0	.....
Average,	10.0	6.7	11.7	6.3	58.0	7.3	4
Buckwheat middlings:							
Minimum,	9.5	4.4	25.1	2.4	36.3	5.7	.....
Maximum,	16.3	5.5	31.3	5.7	52.7	8.1	.....
Average,	13.2	4.8	28.9	4.1	41.9	7.1	.....
Cotton seed meal:							
Minimum,	5.8	5.7	23.3	1.3	15.7	8.8	.....
Maximum,	18.5	8.8	50.8	10.1	38.7	18.0	.....
Average,	8.2	7.2	42.3	5.6	23.6	13.1	35
Cotton seed hulls:							
Minimum,	9.2	1.8	2.2	37.9	12.4	0.6	.....
Maximum,	16.7	4.4	5.4	67.0	41.8	5.4	.....
Average,	11.1	2.8	4.2	46.3	33.4	2.2	20
Linseed meal, old process:							
Minimum,	5.6	4.6	27.7	4.7	28.4	5.2	.....
Maximum,	12.4	8.2	38.2	12.9	41.9	11.6	.....
Average,	9.2	5.7	32.9	8.9	35.4	7.9	21
Linseed meal, new process:							
Minimum,	6.0	5.0	27.1	7.6	35.2	1.3	.....
Maximum,	13.4	6.9	38.4	4.0	48.0	4.4	.....
Average,	10.1	5.8	38.2	9.5	38.4	3.0	14
Peanut meal:*							
Minimum,	6.6	3.7	37.5	2.5	28.5	5.8	.....
Maximum,	15.4	5.5	52.4	7.4	30.8	17.5	.....
Average,	10.7	4.9	47.6	5.1	23.7	8.0	2,480
Peanut hulls:							
Minimum,	7.8	1.9	4.6	56.5	9.7	0.9	.....
Maximum,	10.8	4.6	8.6	72.3	18.9	2.0	.....
Average,	9.0	3.4	6.6	64.3	15.1	1.6	5

*Mostly European analyses.

Composition of Feeding Stuffs.—Continued.

	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Number of analyses.
MILK AND ITS BY-PRODUCTS.							
Whole milk:	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	
Minimum,	80.3	0.4	2.1	.....	2.1	1.7	.....
Maximum,	90.7	1.2	6.4	.....	6.1	6.5	.....
Average,	87.2	6.7	3.6	.....	4.9	3.7	798
Skim milk, cream raised by setting:							
Minimum,	88.3	0.5	2.6	.....	3.8	0.2	.....
Maximum,	92.6	1.0	3.9	.....	5.5	2.5	.....
Average,	90.4	0.7	3.3	.....	4.7	0.9	96
Skim milk, cream raised by separator:							
Minimum,	89.8	.....	.....	.....	.....	.....	.....
Maximum,	91.2	.....	.....	.....	.....	.....	.....
Average,	90.6	0.7	3.1	.....	5.3	0.3	7
Butter milk:							
Minimum,	82.2	0.4	1.7	.....	2.5	.....	.....
Maximum,	93.3	0.9	6.2	.....	5.6	5.4	.....
Average,	90.1	0.7	4.0	.....	4.0	1.1	85
Whey:							
Minimum,	93.2	0.3	0.3	.....	4.4	0.0	.....
Maximum,	94.6	0.6	1.2	.....	5.8	0.2	.....
Average,	93.8	0.4	0.6	.....	5.1	0.1	46

APPENDIX.

FOOD CONTROL LAWS OF THE VARIOUS STATES:

CONNECTICUT.

MAINE.

MASSACHUSETTS.

NEW JERSEY.

NEW YORK.

PENNSYLVANIA.

RHODE ISLAND.

VERMONT.



FOOD CONTROL LAWS OF THE VARIOUS STATES.

Connecticut.

An act concerning the regulation of the sale of concentrated commercial feeding stuffs.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section 1. Every lot or parcel of concentrated commercial feeding stuff, as defined in section three of this act, used for feeding domestic animals, sold, offered, or exposed for sale within this State, shall have affixed thereto in a conspicuous place on the outside thereof, a legible and plainly printed statement, clearly and truly certifying the number of net pounds of feeding stuff contained therein, the name, brand, or trade-mark under which the article is sold, the name and address of the manufacturer or importer and a statement of the percentage it contains of crude fat and of crude protein, allowing one per cent. of nitrogen to equal six and one-fourth per cent. of protein, both constituents to be determined by the methods adopted at the time by the Association of Official Agricultural Chemists of the United States.

Section 2. The term concentrated commercial feeding stuffs as herein used shall not include hays and straws, the whole seeds nor the unmixed meals made directly from the seed of wheat, rye, barley, oats, Indian corn, buckwheat or broom corn.

Section 3. The term concentrated commercial feeding stuff as herein used shall include linseed meals, cotton seed meals, pea meals, cocoanut meals, gluten meals, gluten feeds, maize feeds, starch feeds, sugar feeds, dried brewers' grains, malt sprouts, hominy feeds, cerealine feeds, rice meals, oat feeds, corn and oat chops, corn and oat feeds, ground beef or fish scraps, mixed feeds, provender, bran, middlings, and mixed feeds made wholly or in part from wheat, rye or buckwheat, and all materials of a similar nature not included in section two of this act.

Section 4. Each and every manufacturer, importer, agent, or seller of any concentrated commercial feeding stuff shall, upon request, file with the Connecticut Agricultural Experiment Station a certified copy of the statement named in section one of this act.

Section 5. Each and every manufacturer, importer, agent, or person selling, offering, or exposing for sale in this State any concentrated commercial feeding stuff, as defined in section three of this act, without the statement required by section one of this act, and stating that said feeding stuff contains substantially a larger percentage of either of the constituents mentioned in section one than is contained therein, or in relation to which the provisions of all of the foregoing sections have not been fully complied with, shall be fined not exceeding one hundred dollars for the first offense and not exceeding two hundred dollars for each subsequent offense.

Section 6. The Connecticut Agricultural Experiment Station is hereby authorized to have collected a sample not exceeding two pounds in weight, for analysis from any lot, parcel, or package of concentrated commercial feeding stuff as defined by section three of this act, or unmixed meals, brans, or middlings named in section two of this act, which may be in the possession of any manufacturer, importer, agent, or dealer, but said sample shall be taken in the presence of said party or parties in interest or their representatives, and taken from a number of parcels or packages which shall be not less than five per cent. of the whole lot inspected, and shall be thoroughly mixed, divided into two samples, placed in glass vessels, carefully sealed, and a label placed on each stating the name or brand of the feeding stuff or material sampled, the names of the party from whose stock the sample was taken and the time and place of taking the same, and said label shall be signed by said chemist or his deputy, and by the party or parties in interest or their representatives present at the taking and sealing of said sample; one of said samples shall be retained by said chemist or his deputy and the other by the party whose stock is sampled. Said Connecticut Agricultural Experiment Station shall cause at least one sample of each brand of feeding stuff collected as herein provided to be analyzed annually by or under the direction of said chemist. Said analysis shall include determinations of crude fat and crude protein and such other determinations as may at any time be deemed advisable. Said Connecticut Agricultural Experiment Station shall cause the analysis so made to be published in Station bulletins, together with such other additional information in relation to the character, composition, and use thereof as may seem to be of importance, and issue the same annually, or more frequently, if deemed advisable.

Section 7. It shall be the duty of the Dairy Commissioner to attend to the enforcement of this act, and when any evidence is submitted by the Connecticut Agricultural Experiment Station that the provisions of this act have been violated, he shall make complaint to the proper prosecuting officer, to the end that the violator may be prosecuted.

Section 8. The term importer for all the purposes of this act is intended to apply to such person or persons as shall bring into or offer for sale within this State, concentrated commercial feeding stuffs manufactured without this State.

Section 9. This bill shall not apply to feed ground from whole grain and sold directly from manufacturer to consumer.

Section 10. All acts or parts of acts inconsistent herewith are hereby repealed.

Section 11. This act shall take effect on and after July first, 1899.

Approved June 20, 1899.

Maine.

An act to regulate the sale and analysis of concentrated commercial feeding stuff.

Section 1. Every manufacturer, company or person who shall sell, offer or expose for sale or for distribution in this State any concentrated commercial feeding stuff, as defined in section three of this act, used for feeding farm live stock, shall, in addition to the tax tag, described in section five of this act, affix to every package of such feeding stuff in a conspicuous place on the outside thereof, a plainly printed statement clearly and truly certifying the number of net pounds in package sold or offered for sale, the name or trade mark under which the article was sold, the name of manufacturer or shipper, the place of manufacture, the place of business and the chemical analysis stating the percentage of crude protein, allowing one per cent. of nitrogen to equal six and one-fourth per cent. of protein, and of crude fat it contains, both constituents to be determined by the methods adopted at the time by the Association of Official Agricultural Chemists.

Section 2. The term concentrated commercial feeding stuff, as here used, shall not include hays and straws, the whole seeds nor the unmixed meal made directly from the entire grains of wheat, rye, barley, oats, Indian corn, buckwheat and broom corn. Neither shall it include wheat, rye and buckwheat brans or middlings not mixed with other substances, but sold separately, as distinct articles of commerce, nor pure grains ground together.

Section 3. The term concentrated commercial feeding stuff, as here used, shall include linseed meals, cotton seed meals, pea meals, cocoanut meals, gluten meals, gluten feed, maize feeds, starch feeds, sugar feeds, dried brewers' grains, malt sprouts, hominy feeds, cerealine feeds, rice meals, oat feeds, corn-and-oat chops, ground beef or fish scraps, mixed feeds and all other materials of similar nature not included within section two of this act.

Section 4. Before any manufacturer, company or persons shall sell or offer or expose for sale in this State any concentrated commercial feeding stuffs as defined in section three of this act, he or they shall for each and every feeding stuff bearing a distinguishing name or trade mark, file with the Director of the Maine Agricultural Experiment Station a certified copy of the statement named in section one of this act, said certified copy to be accompanied, when the Director shall so request, by sealed glass jar or bottle containing at least one pound of feeding stuff to be sold or offered for sale, and the company or person furnishing said sample shall thereupon make affidavit that said sample corresponds within reasonable limits to the feeding stuffs it represents, in the percentage of protein and fat which it contains.

Section 5. Each manufacturer, importer, agent or seller of any concentrated commercial feeding stuff, as defined in section three of this act, shall pay to the Director of the Maine Agricultural Experiment Station an inspection tax of ten cents per ton for each ton of such concentrated feeding stuff sold or offered for sale in the State of Maine, and shall affix to each car shipped in bulk and to each bag, barrel or other package of such concentrated feeding stuff, a tag to be furnished by said Director, stating that all charges specified in this section have been paid. The Director of said Experiment Station is hereby empowered to prescribe the forms for such tags, and adopt such regulations as may be necessary for the enforcement of the law. Whenever the manufacturer or importer or shipper of a concentrated feeding stuff shall have filed the statement made in section one of this act and paid the inspection tax, no agent or seller of said manufacturer, importer or shipper shall be required to file such statements or pay such tax. The amount of the inspection tax received by said Director shall be paid by him into the treasury of the Maine Agricultural Experiment Station. The treasurer of said Station shall make an annual report of the receipts and expenditures of funds from this inspection tax, and all receipts in excess of three thousand dollars shall be carried into the State treasury.

Section 6. Any manufacturer, importer or person who shall sell, or offer or expose for sale or for distribution in this State any concentrated commercial feeding stuffs, as defined in section three of this act, without complying with the requirements of the preceding section of this act, or any feeding stuff which contains substantially a smaller percentage of constituents than are certified to be contained, shall, on conviction in a court of competent jurisdiction, be fined not more than one hundred dollars for the first offense, and not more than two hundred dollars for each subsequent offense.

Section 7. The Director of the Maine Experiment Station shall annually analyze, or cause to be analyzed, at least one sample to be

taken in the manner hereinafter prescribed of every concentrated commercial feeding stuff sold or offered for sale under the provisions of this act. Said Director is hereby authorized and directed in person or by deputy to take a sample, not exceeding two pounds in weight, for said analysis from any lot or package of concentrated commercial feeding stuff which may be in the possession of any manufacturer, importer, agent or dealer in this State; but said sample shall be drawn in the presence of said party or parties in interest, or their representatives, and taken from a parcel or a number of packages, which shall not be less than ten per cent. of the whole lot sampled and shall be thoroughly mixed, and then divided into two equal samples, and placed in glass vessels, and carefully sealed and a label placed on each, stating the name of brand of the feeding stuff or material sampled, the name of the party from whose stock the sample was drawn and the time and place of drawing, and said label shall also be signed by the Director, or his deputy, and by the party or parties in interest or their representatives at the drawing and sealing of said samples; one of said duplicate samples shall be retained by the Director and the other by the party whose stock was sampled; and the sample or samples retained by the Director shall be for comparison with the certified statement named in section four of this act. The result of the analysis of the sample or samples so procured, together with such additional information as circumstances advise, shall be published in the report or bulletins from time to time.

Section 8. Whenever the Director becomes cognizant of the violation of any of the provisions of this act, he shall report such violation to the Secretary of the Board of Agriculture, and said Secretary shall prosecute the party or parties thus reported; but it shall be the duty of said Secretary, upon thus ascertaining any violation of this act, to forthwith notify the manufacturer, importer or dealer in writing, and give him not less than thirty days thereafter in which to comply with the requirements of this act; but there shall be no prosecution in relation to the quality of any concentrated commercial feeding stuff if the same shall be found substantially equivalent to the certified statement named in section four of this act.

Section 9. All acts and parts of acts inconsistent with this act are hereby repealed.

Section 10. This act shall take effect October the 1st, 1897.

Massachusetts.

An act relative to concentrated commercial feed stuffs.

Section 1. The Director of the Hatch Experiment Station of the Massachusetts Agricultural College is hereby authorized and directed

in person or by deputy, to take samples not exceeding two pounds in weight from any lot or package of concentrated commercial feed stuff, used for feeding any kind of farm live stock, which may be in the possession of any manufacturer, importer, agent or dealer, cause the same to be analyzed for the amount of crude protein and crude fat contained therein, as well as for other ingredients if thought advisable, and cause the results of the analyses to be published from time to time in specially prepared bulletins, with such additional information as circumstances advise: Provided, however, That in publishing the results of the analyses the names of the jobbers or local dealers selling the said feed stuffs shall not be used, but the commodity analyzed shall be identified and described by the name of the manufacturer and the commercial name or designation by which it is known in the trade.

Section 2. Whenever requested said samples shall be taken in the presence of the party or parties in interest or their representatives and shall in all cases be taken from a parcel or number of packages which shall not be less than five per cent. of the whole lot inspected, shall be thoroughly mixed and then divided into two equal samples and put in glass vessels and carefully sealed, and a label placed on each vessel stating the name or brand of the feed stuff or material sampled, the name of the manufacturer when possible, the name of the party from whose stock the sample was taken, and the time and place of taking; said label shall be signed by the Director, or his deputy, and by the party or parties in interest or their representatives, if present at the taking and sealing of the samples. One of said duplicate samples shall be retained by the Director and the other by the party whose stock was sampled.

Section 3. This act shall take effect on the first day of July in the year eighteen hundred and ninety-seven. (Approved March 5, 1897.)

New Jersey.

Be it enacted by the Senate and General Assembly of the State of New Jersey:

1. Every lot or parcel of concentrated commercial feeding stuff as defined in section two of this act, used for feeding domestic animals, sold, offered or exposed for sale within this State, shall have affixed thereto, in a conspicuous place on the outside thereof a legible and plainly printed statement, clearly and truly certifying the number of net pounds of feeding stuff contained therein, the name, brand

of the trade mark under which the article is sold, the name and address of the manufacturer or importer, and a statement of the percentage it contains of crude fat and of crude protein, allowing one per centum of nitrogen to equal six and one-fourth per centum of protein, both constituents to be determined by the methods of the Association of Official Agricultural Chemists of the United States; but if the feeding stuff is sold in bulk or in packages belonging to the purchaser, the agent or dealer, upon request of the purchaser, shall furnish to him the certified statement named in this section.

2. The term concentrated commercial feeding stuff used in this act shall include linseed meal, cotton seed meals, pea meals, peanut meals, cocoanut meals, gluten meals, gluten feeds, maize feeds, starch feeds, sugar feeds, dried brewers' grains, malt sprouts, hominy feeds, cerealine feeds, rice meals, oat feeds, corn and oat chop, ground beef or fish scraps, mixed feeds, and all other materials of similar nature.

3. The term concentrated commercial feeding stuffs shall not include hays and straws, the whole seeds nor the unmixed meals made directly from the entire grains of wheat, rye, barley, oats, Indian corn, buckwheat and broom corn; neither shall it include wheat, rye and buckwheat brans or middlings, not mixed with other substances, but sold separately, as distinct articles of commerce, nor pure grains ground together.

4. Each and every manufacturer, importer, agent or seller of any concentrated commercial feeding stuff shall, during the month of November, file with the New Jersey Agricultural Experiment Station a certified copy of the statement named in section one of this act and, upon request, shall furnish a sealed glass jar or bottle containing a representative sample of at least one pound of the feeding stuff to be sold or offered for sale.

5. Each and every manufacturer, importer, agent or person selling, offering or exposing for sale in this State any concentrated commercial feeding stuff, as defined in section two of this act, without the statement required by section one of this act, or stating that said feeding stuff contains substantially a larger percentage of either of the constituents mentioned in section one than is contained therein, or in relation to which the provisions of all the foregoing sections have not been fully complied with, shall be fined not exceeding one hundred dollars for the first offense, and not exceeding two hundred dollars for each subsequent offense.

6. Any person who shall adulterate any kind of meal or ground grain with milling or manufacturing offals, or any other substance whatever, for the purpose of sale, unless the true composition, mixture or adulteration thereof is plainly marked or indicated upon the package containing the same, or in which it is offered for sale or any

person who knowingly sells or offers for sale any meal or ground grain which has been so adulterated, unless the true composition, mixture, or adulteration is plainly marked or indicated upon the package containing the same, or in which it is offered for sale shall be fined not less than twenty-five dollars nor more than one hundred dollars for each offense.

7. All penalties imposed under this act shall be paid into the treasury of this State, for the purpose of defraying the expenses of the prosecution.

8. The New Jersey Agricultural Experiment Station is hereby authorized to have collected a sample, not exceeding two pounds in weight, for analysis, from any lot, parcel or package of any concentrated commercial feeding stuff as defined by section two of this act, or any kind of material which is used in the feeding of domestic animals, and which may be in the possession of any manufacturer, importer, agent or dealer, but said sample shall be taken in the presence of said party or parties in interest, or their representatives, and taken from a number of parcels or packages which shall not be less than five per centum of the whole lot inspected, and shall be thoroughly mixed, divided into two samples, placed in glass vessels, carefully sealed, and a label placed on each stating the name or brand of the feeding stuff or material sampled, the name of the party from whose stock the sample was taken, and the time and place of taking the same, and said label shall be signed by the collector or his deputy, and by the party or parties in interest or their representatives present at the taking and sealing of said samples; one of said samples shall be retained by the collector or his deputy, and the other by the party whose stock is sampled; said New Jersey Agricultural Experiment Station shall cause at least one sample of each brand of feeding stuff collected as herein provided to be analyzed annually; said analysis shall include determinations of crude fat and crude protein, and such other determinations as may at any time be deemed advisable; said New Jersey Agricultural Experiment Station shall cause the analysis so made to be published in Station bulletins, together with such other additional information in relation to the character, composition and use thereof as may seem to be of importance, and issue the same annually, or more frequently, if deemed advisable.

9. Whenever the New Jersey Agricultural Experiment Station becomes cognizant of the violation of any of the provisions of this act, such violation shall be reported to the Secretary of the State Board of Agriculture, and said Secretary of the State Board of Agriculture shall make complaint to the proper prosecuting officer to the end that the violator may be prosecuted.

10. The term importer for all the purposes of this act is intended to apply to such person or persons as shall bring into or offer for sale within this State, concentrated commercial feeding stuffs manufactured without this State.

11. The expenses incurred by the New Jersey Agricultural Experiment Station in carrying out the provisions of this act, when presented to the comptroller of the State, accompanied by the proper vouchers, duly certified by the President and Secretary of the Board of Managers, shall upon warrant of said comptroller be paid out of the State treasury: Provided, Such expenses do not exceed the sum of three thousand dollars in any year.

12. This act shall take effect when the sum provided for expenses in section eleven has been duly appropriated.

Passed March 15, 1900.

New York.

The people of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Chapter three hundred and thirty-eight of the laws of eighteen hundred and ninety-three, entitled "An act in relation to agriculture, constituting articles one, two, three, four and five of chapter thirty-three of the general laws," is hereby amended by adding at the end thereof a new article to be known as article nine, and to read as follows:

Article IX.

Sale and analysis of concentrated commercial feeding stuffs.

Section 120. Term "concentrated commercial feeding stuffs" defined.

Section 121. Statements to be attached to packages; contents; analysis.

Section 122. Statements to be filed with Director of Agricultural Experiment Station; to be accompanied by sample.

Section 123. License fee.

Section 124. Analysis to be made by Director of Experiment Station; samples to be taken for analysis.

Section 125. Penalty for violation of article.

Section 126. Sale of adulterated meal or ground grains; penalty.

Section 127. Violation to be reported to the Commissioner of Agriculture.

120. Term "*concentrated commercial feeding stuffs*" defined: The term "concentrated commercial feeding stuffs," as used in this article shall include linseed meals, cotton-seed meals, pea meals, cocoa-

nut meals, gluten meals, gluten feeds, maize feeds, starch feeds, sugar feeds, dried brewers' grains, malt sprouts, hominy feeds, cerealine feeds, rice meals, oat feeds, corn and oat chops, ground beef or fish scraps, mixed feeds, and all other material of similar nature; but shall not include hays and straws, the whole seeds nor the unmixed meals made directly from the entire grains of wheat, rye, barley, oats, Indian corn, buckwheat and broom corn. Neither shall it include wheat, rye and buckwheat brans or middlings, not mixed with other substances, but sold separately, as distinct articles of commerce, nor pure grains ground together.

121. *Statements to be attached to packages; contents; analysis:* Every manufacturer, company or person who shall sell, offer or expose for sale or for distribution in this State any concentrated commercial feeding stuff, used for feeding farm live stock, shall furnish with each car or other amount shipped in bulk and shall affix to every package of such feeding stuff in a conspicuous place on the outside thereof, a plainly printed statement clearly and truly certifying the number of net pounds in the package sold or offered for sale, the name or trade mark under which the article is sold, the name of the manufacturer or shipper, the place of manufacture, the place of business and a chemical analysis stating the percentages it contains of crude protein, allowing one per centum of nitrogen to equal six and one-fourth per centum of protein, and of crude fat, both constituents to be determined by the methods prescribed by the Director of the New York Agricultural Experiment Station. Whenever any feeding stuff is sold at retail in bulk or in packages belonging to the purchaser, the agent or dealer, upon request of the purchaser, shall furnish to him the certified statement named in this section.

122. *Statements to be filed with Director of Agricultural Experiment Station; to be accompanied by sample.* Before any manufacturer, company or person shall sell, offer or expose for sale in this State any concentrated commercial feeding stuffs, he or they shall for each and every feeding stuff bearing a distinguishing name or trade mark, file annually during the month of December with the Director of the New York Agricultural Experiment Station a certified copy of the statement specified in the preceding section, said certified copy to be accompanied, when the Director shall so request, by a sealed glass jar or bottle containing at least one pound of the feeding stuff to be sold or offered for sale, and the company or person furnishing said sample shall thereupon make affidavit that said sample corresponds within reasonable limits to the feeding stuff which it represents, in the percentage of protein and fat which it contains.

123. *License fee.* Each manufacturer, importer, agent or seller of any concentrated commercial feeding stuffs shall pay annually during the month of December to the treasurer of the New York Agricultural Experiment Station a license fee of twenty-five dollars. Whenever a manufacturer, importer, agent or seller of concentrated commercial feeding stuffs desires at any time to sell such material and has not paid the license fee therefor in the preceding month of December, as required by this section, he shall pay the license fee prescribed herein before making any such sale. The amounts of license fees received by such treasurer pursuant to the provisions of this section shall be paid by him to the treasurer of the State of New York. The treasurer of the State of New York shall pay from such amount when duly appropriated the moneys required for the expense incurred in making such inspection required by this section and enforcing the provisions thereof. The Board of Control of the New York Agricultural Experiment Station shall report annually to the Legislature the amount received pursuant to this article, and the expense incurred for salaries, laboratory expenses, chemical supplies, traveling expenses, printing and other necessary matters. Whenever the manufacturer, importer or shipper of concentrated commercial feeding stuffs shall have filed the statement required by section one hundred and twenty-one of this article and paid the license fee as prescribed in this section, no agent or seller of such manufacturer, importer or shipper shall be required to file such statement or pay such fee.

124. *Analysis to be made by Director of Experiment Station; samples to be taken for analysis.* The Director of the New York Experiment Station shall annually analyze, or cause to be analyzed, at least one sample to be taken in the manner hereinafter prescribed, of every concentrated commercial feeding stuff sold or offered for sale under the provisions of this act. Said Director shall cause a sample to be taken, not exceeding two pounds in weight, for said analysis, from any lot or package of such commercial feeding stuff which may be in the possession of any manufacturer, importer, agent or dealer in this State; but said samples shall be drawn in the presence of the parties in interest, or their representatives and taken from a parcel or a number of packages, which shall not be less than ten per centum of the whole lot sampled, and shall be thoroughly mixed, and then divided into equal samples, and placed in glass vessels, and carefully sealed and a label placed on each, stating the name of the party from whose stock the sample was drawn and the time and place of drawing, and said label shall also be signed by the person taking the sample, and by the party or parties in interest or their representatives at the drawing and sealing of said samples; one of said duplicate sam-

ples shall be retained by the Director and the other by the party whose stock was sampled; and the sample or samples retained by the Director shall be for comparison with the certified statement named in section one hundred and twenty-two of this article. The result of the analyses of the sample or samples so procured, together with such additional information as circumstances advise, shall be published in reports or bulletins from time to time.

125. *Penalty for violation of article.* Any manufacturer, importer, or person who shall sell, offer or expose for sale or for distribution in this State any concentrated commercial feeding stuff, without complying with the requirements of this article, or any feeding stuff which contains substantially a smaller percentage of constituents than are certified to be contained, shall, on conviction in a court of competent jurisdiction, be fined not more than one hundred dollars for the first offense, and not more than two hundred dollars for each subsequent offense.

126. *Adulterated meal or ground grain; penalty.* Any person who shall adulterate any kind of meal or ground grain with milling or manufacturing offals, or any other substance whatever, for the purpose of sale, unless the true composition, mixture or adulteration thereof is plainly marked or indicated upon the package containing the same or in which it is offered for sale; or any person who knowingly sells, or offers for sale any meal or ground grain which has been so adulterated unless the true composition, mixture or adulteration is plainly marked or indicated upon the package containing the same, or in which it is offered for sale, shall be fined not less than twenty-five or more than one hundred dollars for each offense.

127. *Violation to be reported to the Commissioner of Agriculture.* Whenever the Director becomes cognizant of the violation of any of the provisions of this article, he shall report such violation to the Commissioner of Agriculture, and said Commissioner of Agriculture shall prosecute the party or parties thus reported; but it shall be the duty of said Commissioner upon thus ascertaining any violation of this article, to forthwith notify the manufacturer, importer or dealer in writing and give him not less than thirty days thereafter in which to comply with the requirements of this article; but there shall be no prosecution in relation to the quality of any concentrated commercial feeding stuff if the same shall be found substantially equivalent to the certified statement named in section one hundred and twenty-two of this article.

Section 2. This act shall take effect December first, eighteen hundred and ninety-nine.

Pennsylvania.

AN ACT

Regulating the sale of concentrated commercial feeding stuffs, defining concentrated feeding stuffs, prohibiting their adulteration, providing for the collection of samples, the expenses of the enforcement of the law, and fixing penalties for its violation.

Section 1. Be it enacted, &c., That every lot or parcel of any concentrated commercial feeding stuff, as defined in section two of this act, used for feeding domestic animals, sold, offered or exposed for sale within this State, shall have affixed thereto, in a conspicuous place on the outside thereof, a legible and plainly printed statement clearly and truly certifying the number of net pounds of feeding stuff contained therein; the name, brand or trade mark under which the article is sold; the name and address of the manufacturer or importer, and a statement of the percentage it contains of crude fat and of crude protein, both constituents to be determined by the methods adopted at the time by the Association of Official Agricultural Chemists of the United States. Whenever any concentrated commercial feeding stuff is sold at retail, in bulk, or in sacks belonging to the purchaser, the agent or dealer, upon request of the purchaser, shall furnish to him the certified statement named in this section.

Statement certifying weight of material, the name or trade mark, etc.

When statement is to be furnished the purchaser.

Section 2. The term "concentrated commercial feeding stuffs," as used in this act, shall include linseed meals, cotton seed meals, gluten meals, maize feeds, starch feeds, sugar feeds, dried brewers' grains, malt sprouts, hominy foods, cerealine feeds, rice meals, ground beef or fish scraps, and all other materials of similar nature, but shall not include hays and straws, the grinding together of pure whole grains, nor the unmixed meals made directly from the entire grains of wheat, rye, barley, oats, Indian corn, buckwheat or broom corn; neither shall it include wheat, rye or buckwheat bran, or middlings not mixed with other substances, and sold separately as distinct articles of commerce.

"Concentrated commercial feeding stuffs" defined.

Section 3. No foreign mineral substance, nor substance injurious to the health of domestic animals, shall be mixed with any feeding stuff sold, or offered, or exposed for sale in this State.

Injurious substances shall not be used.

Filing of certified statement.

Section 4. Each and every manufacturer, importer, agent or seller of any concentrated feeding stuff shall, upon request, file in the office of the Secretary of Agriculture a certified copy of the statement named in section one of this act.

Penalty for omission of statement.

Section 5. Each and every manufacturer, importer, agent or person selling, offering or exposing for sale in this State any concentrated commercial feeding stuff, as defined in section two of this act, without the statement required by section one of this act; or affixing a statement or guarantee which is false in any particular, or in relation to which the provisions of all of the foregoing sections have not been fully complied with, shall, for every such offense, forfeit and pay the sum of one hundred dollars, which shall be recoverable with costs, including the expenses of analysis, by any person suing in the name of the Commonwealth, as debts of like amount are by law recoverable: Provided, That the Secretary of Agriculture shall, together* with his deputies, agents and assistants, be charged with the enforcement of this act, and shall have full access to all places of business, mills, buildings, carriages, cars, vessels and packages, of whatsoever kind, used in the manufacture, importation or sale of any concentrated commercial feeding stuff; and shall also have power and authority to open any package containing or supposed to contain any concentrated commercial feeding stuff, and take therefrom samples for analysis, upon tendering the value of said sample; and whenever requested, said samples shall be taken in the presence of the party or parties interested or their representative, shall be thoroughly mixed and then divided into two samples and put in glass vessels and carefully sealed and a label placed upon each vessel stating the name or brand of the feeding stuff or material sampled, the name of the manufacturer when possible, the name of the party from whose stock the sample was taken, and the time and the place of taking, said labels to be signed by the Secretary of Agriculture or his agent, and by the party or parties interested or their representative, if present, at the taking of the samples. One of said duplicate samples shall be retained by the Secretary of Agriculture or his agent, and the other by the party whose stock was sampled.

Proviso.

Powers and duties of Secretary of Agriculture and his agents.

The taking and labeling of samples.

Retention of samples.

Section 6. All necessary expenses under the provisions of this act shall, after approval in writing by the Governor and the Secretary of Agriculture, be paid by the State Treasurer upon the warrant of the Auditor General, in the same manner now provided by law: Provided, That not more than five thousand dollars shall be expended in any one year, and all penalties and costs for the violation of the provisions of this act shall be paid to the said Secretary of Agriculture or his agent, and by him immediately covered into the State Treasury, to be kept as a separate fund, for the use of the Department in carrying out the provisions of this act, and to be drawn out upon warrants signed by the Secretary of Agriculture and the Auditor General.

Payment of necessary expenses.

Proviso.

Application of penalties and costs.

Section 7. Every person who violates any of the provisions of this act shall also be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than fifty dollars nor more than one hundred dollars, or by imprisonment in the county jail for not less than ten nor more than thirty days, or both fine and imprisonment for the first offense, and a fine of one hundred dollars and imprisonment for every subsequent offense: Provided, That all fines and costs, including the expenses of analysis, imposed and recovered under this section shall be covered into the State Treasury, as provided by section six of this act.

Violation of act a misdemeanor.

Fine and penalty

Proviso.

Section 8. Magistrates and justices of the peace throughout this Commonwealth shall have jurisdiction to hear and determine actions arising from violation of the provisions of this act, and to hold for court or impose the penalties prescribed therein, subject to appeal as the law shall direct.

Jurisdiction of magistrates.

Section 9. This act shall take effect on the first day of October, one thousand nine hundred and one.

Act to take effect

Section 10. All acts or parts of acts inconsistent with the provisions of this act are hereby repealed.

Repeal.

Approved—The 25th day of April, A. D. 1901.

WILLIAM A. STONE.

Rhode Island.

An act to regulate the sale of concentrated commercial feeding stuffs.

It is enacted by the General Assembly as follows:

Section 1. Every lot or parcel of any concentrated commercial feeding stuff, as defined in section 3 of this act, used for feeding domestic animals, sold, offered, or exposed for sale, in this State, shall have affixed thereto, in a conspicuous place on the outside thereof, a legible and plainly printed statement, stating and truly certifying the number of net pounds of feeding stuffs contained therein, the name, brand, or trade mark under which the article is sold, the name and address of the manufacturer or importer, and a statement of the percentage it contains of crude protein, allowing one per cent. of nitrogen to equal six and one-fourth per cent. of protein, and of crude fat, both constituents to be determined by the methods adopted at the time by the Association of Official Agricultural Chemists of the United States.

Section 2. The term concentrated commercial feeding stuff, as herein used, shall not include hays and straws, the whole seeds, nor the unmixed meals made directly from the seed of wheat, rye barley, oats, Indian corn, buckwheat or broom corn; nor shall it include wheat, rye and buckwheat brans or middlings unmixed with other substances and sold separately as distinct articles of commerce.

Section 3. The term concentrated commercial feeding stuffs, as herein used, shall include linseed meals, cotton seed meals, pea meals, cocoanut meals, gluten meals, gluten feeds, maize feeds, starch feeds, sugar feeds, dried brewers' grains, malt sprouts, hominy feeds, cerealine feeds, rice meals, oat feeds, corn and oat chop, corn and oat feeds, ground beef or fish scraps, mixed feeds, provenders, and all materials of a similar nature not included within section 2 of this act.

Section 4. Each and every manufacturer, importer, agent, or seller of any concentrated commercial feeding stuff, shall, upon request, file with the Board of Managers of the Rhode Island College of Agriculture and Mechanic Arts, a certified copy of the statement named in section 1 of this act.

Section 5. Each and every manufacturer, importer, agent, or person selling, offering, or exposing for sale in this State any concentrated commercial feeding stuff, as defined in section 3 of this act, without the statement required by section 1 of this act, stating that said feeding stuff contains substantially a larger percentage of either of the constituents mentioned in section 1 than is contained therein, or in relation to which the provisions of all the foregoing sections have not been fully complied with, shall be fined not exceeding one hundred dollars for the first offense, and not exceeding two hundred dollars for each subsequent offense.

Section 6. The Board of Managers of the Rhode Island College of Agriculture and Mechanic Arts is hereby authorized to have collected by the chemist of the Agricultural Experiment Station, or by a deputy or deputies of said chemist, a sample, not exceeding two pounds in

weight, for analysis, from any lot, parcel, or package of concentrated commercial feeding stuff as defined by section 3 of this act, or unmixed meals, brans, or middlings named in section 2 of this act, which may be in the possession of any manufacturer, importer, agent or dealer, but said sample shall be taken in the presence of such party or parties in interest, or their representatives, and taken from a number of parcels or packages which shall not be less than five per cent. of the whole lot inspected, and shall be thoroughly mixed, divided into two samples, placed in glass vessels, carefully sealed, and a label placed on each stating the name or brand of the feeding stuff or material sampled, the name of the party from whose stock the sample was taken, and the time and place of taking the same; and said label shall be signed by said chemist, or his deputy, and by the party or parties in interest, or their representatives, present at the taking or sealing of said sample; one of said samples shall be retained by said chemist, or his deputy, and the other by the party whose stock was sampled. Said Board of Managers shall cause at least one sample of each brand of feeding stuff collected, as herein provided, to be analyzed annually by or under the direction of said chemist. Said analysis shall include determinations of crude fat and crude protein and such other determinations as may be at any time deemed advisable. Said Board of Managers shall cause the analyses so made to be published in Station bulletins, together with such additional information in relation to the character, composition, and use thereof as may seem to be of importance and issue the same annually, or more frequently if deemed advisable.

Section 7. It shall be the duty of the Board of Managers of the Rhode Island College of Agriculture and Mechanic Arts to prosecute every person violating the provisions of this act, and for this purpose said Board of Managers may employ experts, if necessary, and may designate some one of their own number, or some person connected with said College, to make complaints in its behalf, and, in making complaints for violations thereof, such person so designated shall not be required to enter into any recognizance or give surety for the payment of costs.

Section 8. The term importer, for all the purposes of this act, is intended to apply to such person or persons as shall bring into and offer for sale, within this State, concentrated commercial feeding stuffs manufactured without the State.

Section 9. The sum of thirteen hundred dollars, or so much thereof as may be necessary, is hereby appropriated, annually, out of any money in the treasury not otherwise appropriated, for the purpose of defraying the expenses of collection, analysis, distribution of bulletins, correspondence, laboratory fittings, chemicals, and such other expenses as are incident to and properly arise from the execution of

the provisions of this act; and the State Auditor shall draw his order upon the general treasurer for said sum, or so much thereof as may be necessary, on the presentation of vouchers properly authenticated by the Board of Managers of the Rhode Island College of Agriculture and Mechanic Arts, and approved by the Governor.

Section 10. This act shall take effect on and after July 1st, 1899.

Vermont.

An act to regulate the sale of concentrated commercial feeding stuffs.

It is hereby enacted by the General Assembly of the State of Vermont:

Section 1. Every lot or parcel of any concentrated commercial feeding stuff, as defined in section three of this act, used for feeding farm live stock, sold, offered or exposed for sale in the State of Vermont, shall, in addition to the tax tag described in section five of this act, have affixed thereunto, in a conspicuous place on the outside thereof, a plainly printed statement clearly and truly certifying the number of net pounds of feeding stuff in a package, the name, brand or trade mark under which the article is sold, the name and address of the manufacturer or importer, the place of manufacture, and a chemical analysis stating the percentages it contains, of crude protein, allowing one per cent. of nitrogen to equal six and one-fourth per cent. of protein, and of crude fat, both constituents to be determined by the methods adopted at the time by the Association of Official Agricultural Chemists: Provided, That the statement of the percentage of crude fat may be omitted if it does not exceed three per cent.

Section 2. The term concentrated commercial feeding stuff, as here used, shall not include hays and straws, the whole seed nor the unmixed meals made directly from the entire grains of wheat, rye, barley, oats, Indian corn, buckwheat and broom corn. Neither shall it include wheat, rye and buckwheat brans or middlings, nor pure grains ground together, nor wheat bran or middlings mixed together or with other feed.

Section 3. The term concentrated commercial feeding stuff, as here used, shall include linseed meals, cotton-seed meals, pea meals, coconut meals, gluten meals, gluten feeds, maize feeds, starch feeds, sugar feeds, dried brewers' grains, malt sprouts, hominy feeds, cerealine feeds, rice meals, oat feeds, corn and oat chops, corn and oat feeds, ground beef or fish, mixed feeds, provenders, and all other materials of a similar nature not included within section two of this act.

Section 4. Before any concentrated commercial feeding stuff, as defined in section three of this act, is sold, offered or exposed for sale, the importer, manufacturer or party who causes it to be sold or offers it for sale within the State of Vermont, shall, for each and every feeding stuff bearing a distinguishing name and trade mark, file with the Director of the Vermont Agricultural Experiment Station a certified copy of the statement named in section one of this act, and shall also deposit with said Director, at his request, a sealed glass jar or bottle containing not less than one pound of the feeding stuff to be sold or offered for sale, accompanied by an affidavit that it is a fair average sample thereof and corresponds within reasonable limits to the feeding stuff which it represents in the percentage of protein and fat which it contains.

Section 5. The manufacturer, importer, agent or seller of each concentrated commercial feeding stuff as defined in section three of this act, shall, before the article is offered for sale, pay to the Director of the Vermont Agricultural Experiment Station an inspection tax of ten cents per ton for each ton of such concentrated feeding stuff sold or offered for sale in the State of Vermont, and shall affix to each car shipped in bulk and to each bag, barrel or other package of such concentrated feeding stuff, a tag to be furnished by said Director, stating that all charges specified in this section have been paid. The Director of said Experiment Station is hereby empowered to prescribe the forms for such tags, and adopt such regulations as may be necessary for the enforcement of the law. Whenever the manufacturer or importer or shipper of a concentrated feeding stuff shall have filed the statement made in section one of this act and paid the inspection tax, no agent or seller of said manufacturer, importer or shipper shall be required to file such statement or pay such tax. The amount of inspection tax received by said Director shall be paid by him to the State Treasurer. So much of the inspection tax collected under this act shall be paid by the State Treasurer to the treasurer of said Experiment Station as the Director of said Experiment Station may show by his bills has been expended in performing the duties required by this act, but in no case to exceed the amount of the inspection tax received by the State Treasurer under this act, such payment to be made quarterly upon the order of the Auditor of Accounts, who is hereby directed to draw his order for such purpose.

Section 6. Any manufacturer, importer, agent or person selling, offering or exposing for sale any concentrated commercial feeding stuff, as defined in section three of this act, without the statement required by section one and the tax tag required by section five of this act, or with a label stating that said feeding stuff contains substantially a larger percentage of either of the constituents mentioned

in section one than is contained therein, shall on conviction in a court of competent jurisdiction be fined not more than fifty dollars for the first offense, and not more than one hundred dollars for each subsequent offense.

Section 7. All manufacturers and importers of concentrated commercial feeding stuffs, or dealers in the same, shall, when requested, furnish the Director of the Vermont Agricultural Experiment Station with a complete list of the names or trade marks of said feeding stuffs, and all agents selling, offering or exposing the same for sale.

Section 8. The Director of the Vermont Agricultural Experiment Station shall cause one analysis or more to be made annually of each concentrated commercial feeding stuff sold or offered for sale under the provisions of this act. Said Director is hereby authorized in person or by deputy to take a sample not exceeding two pounds in weight for analysis from any lot or package of concentrated commercial feeding stuff which may be in the possession of any manufacturer, importer, agent or dealer in this State; but said sample shall be drawn in the presence of said party or parties in interest, or their representative, and shall be taken from a parcel or number of packages which shall not be less than five per cent. of the whole lot inspected, and shall be thoroughly mixed and divided into two equal samples and placed in glass or metal vessels, carefully sealed and a label placed on each stating the name or brand of the feeding stuff or material sampled, the name of the party from whose stock the sample was drawn, and the time and place of drawing, and said label shall be signed by the Director or his deputy and the parties or party in interest, or their representative, present at the drawing and sealing of said sample; one of said duplicate samples shall be retained by the Director and the other by the party whose stock was sampled, and the sample or samples retained by the Director shall be for comparison with the certified statements named in sections one and four of this act. The result of the analysis of the sample or samples so procured, together with such additional information as circumstances advise shall be published in reports or bulletins from time to time.

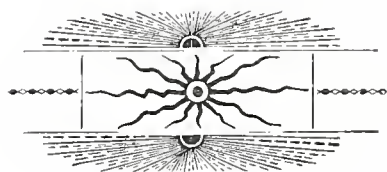
Section 9. The Director of the Vermont Agricultural Experiment Station shall notify the State Treasurer of all violations of this act, and the State Treasurer shall commence a suit in the name of the State against the party or parties thus reported. It shall be the duty of the Treasurer upon ascertaining any violation of this act to forthwith notify the manufacturers and importers, in writing, and to give them not less than thirty days thereafter in which to comply with the requirements of this act. But there shall be no prosecution in relation to the quality of any concentrated feeding stuff if the same shall be found to be substantially equivalent to the statement of analysis made by the manufacturers or importers.

Section 10. The term importer, for all the purposes of this act, shall be taken to mean all who procure or sell concentrated commercial feeding stuffs.

Section 11. All acts or parts of acts inconsistent with this act are hereby repealed.

Section 12. This act shall take effect July 1st, 1899.

Approved November 29, 1898.



INDEX OF MANUFACTURERS AND RETAIL DEALERS.

MANUFACTURERS.

A.

	Page.
Akron Cereal Co., Akron, O.,	40
Aliman Mills, Toledo, O.,	46
American Cattle Feeding Salts Co., New York,	69
American Cereal Co., Chicago,	40, 59, 61, 62
American Glucose Co., Chicago,	50
American Spiced Food Co., Boston,	70
Anglo-American Mf'g Co., Boston,	70
Armstrong & McKelvie, Pittsburg, Pa.,	17

B.

Baldwin, D. M., Jr., Graceville, Minn.,	23, 27, 32
Barner Food Co., Auburn, N. Y.,	70
Barber, D. P., & Sons, Minneapolis, Minn.,	24
Bare Milling Co., Roaring Springs, Pa.,	24, 27, 45, 61
Barwell, J. W., Waukegan, Ill.,	67, 70
Baum's Castorine Co., Syracuse, N. Y.,	70
Beebe, D. H., Corry, Pa.,	46, 59
Benjamin's Food Co., Danbury, Conn.,	71
Bennett & Millett, Gouverneur, N. Y.,	66
Biddle, T. M., Altoona, Pa.,	61
Bieber, J. D., Oley, Pa.,	35
Bliss & Merrick, Corry, Pa.,	24, 27
Brant, Levi, Harrisburg, Pa.,	45, 62
Breck's, Jos., Sons Corporation, Boston,	71
Brooks & Pennock, Philadelphia,	62
Brown, J. S., & Son, Loysburg, Pa.,	61
Buffalo Sugar Refining Co., Buffalo, N. Y.,	50

C.

Central Elevator Co., Pittsburg, Pa.,	45, 59
Cerealine Mf'g Co., Indianapolis, Ind.,	56

Champion Food Co.,	71
Clapper Bros., Martinsburg, Pa.,	24, 27, 45, 62
Cleveland Linseed Meal Co., Cleveland, O.,	17
Craft, J. W., Ambler, Pa.,	17
Cullin, Andrew, Co., New York,	40

D.

Densmore Bros., Erie, Pa.,	24
Dietrich, M. C., Kempton, Pa.,	62
Dow, J. C., Boston, Mass.,	71
Dry, H. F., Oley, Pa.,	45, 59
Dyer, C. F., Millersburg, Pa.,	23, 27

E.

Eastman Bros., Framington, Mass.,	73
Eclipse Milling Co., Brownsville, Pa.,	24, 46
Eggine Co., Hartford, Conn.,	71
Elkhart, Swan Milling Co., Chicago, Ill.,	27
Empire Grain and Elevator Co., Binghamton, N. Y.,	27, 33
Esterbrook, H. A., Fitchburg, Mass.,	72

F.

Foster, C. A., Carnegie, Pa.,	23, 27
Full Frank Grain Co., Milwaukee, Wis.,	23, 27

G.

Gaddis & Co., Uniontown, Pa.,	24, 27, 46
Gibson Bros., Philadelphia,	17
Glucose Sugar Refining Co., Chicago, Ill.,	50
Grandin, D. H., Jamestown, N. Y.,	59
Gring, H. H., Mohnsville, Pa.,	45, 62

H.

Hartz, David, Morgantown, Pa.,	24, 27, 45, 59
Heath, F. L., Corry, Pa.,	24, 59
Heffner, J. Kutztown, Pa.,	59
Herb Medicine Co., Springfield, O.,	72
Hess & Clark, Ashland, O.,	72
H. O. Company, Buffalo, N. Y.,	62
Hunter Bros., St. Louis, Mo.,	23, 27

I.

International Food Company, Minneapolis, Minn.,	72
---	----

J.

Johnson, I. S., Boston, Mass.,	74
--------------------------------------	----

K.

Knight's Stock and Poultry Food Co.,	72
Knight's English Vegetable Food,	72

L.

	Page.
Lechrone, H. W., Duncansville, Pa.,	45
Lewis, John T., Bros. & Co., Philadelphia,	17
Lingafelt, C. E., Hollidaysburg, Pa.,	45, 59
Lord, L. B., Burlington, Vt.,	74

M.

McCague, R. S., & Co., Pittsburg, Pa.,	45
McClaren, Brockton, Mass.,	72
McDermott, Wertz & Co., Johnstown, Pa.,	27, 45, 59
McKenzie & Winslow, Fall River, Mass.,	70
Magic Food Co., Chattanooga and St. Louis,	73
Mann & Allhouse, Easton, Pa.,	35, 62
Marfield & Co., Chillicothe, O.,	52
Mentzer, F. & I., Frankstown, Pa.,	24, 27, 45
Mock, G. W., Rodman's Mills, Pa.,	62
Mulhollen, H.,	46
Muscatine Oatmeal Co., Muscatine, Ia.,	41
Myer's, Niagara Falls, N. Y.,	73

N.

Northwestern Consolidated Milling Co., Minneapolis, Minn.,	23, 27
--	--------

O.

Orr, A. B. Linseed Oil Co., Pequa, O.,	17
--	----

P.

Pain Bros. & Co., Milwaukee, Wis.,	17
Phi. H. Postal Milling Co., Mascoutah, Ill.,	24
Pillsbury Milling Co., Minneapolis, Minn.,	32
Pillsbury and Washburn Co., Minneapolis, Minn.,	34
Pittsburg Milling Co., Pittsburg, Pa.,	24, 27, 75, 55
Post, P. W., Altoona, Pa.,	61
Poultry Supply Co., Boston,	72
Pratt Food Co., Philadelphia,	72
Puritan Mfg Co., Rochester, N. Y.,	71

R.

Rochester Horse and Cattle Food Co., Rochester, N. Y.,	74
Rust, Wm., & Sons, New Brunswick, N. J.,	74

S.

Schmehl, J. H., Scarlett's Mills,	48
Seaboard Milling Co., Reading, Pa.,	24
Sears, C. H., Clark's Summit, Pa.,	33, 46
Shaffer, Wanner & Co., Fleetwood, Pa.,	24
Simpson Bros., Norristown, Pa.,	66, 67
Smith & Romaine, New York,	66

	Page.
Snyder Bros., Dalton, Pa.,	62
Snyder, G. S., Hatfield, Pa.,	46, 62
Stanley, J. J., Lawrence, Mass.,	74
Stevens, G. S., & Co., Minneapolis, Minn.,	23

T.

Thompson & Co., Allegheny, Pa.,	17
Thompson Linseed Oil Co., Pittsburg, Pa.,	17
Thorley Food Co., Chicago, Ill.,	73
Tileston, G., Milling Co., St. Cloud, Minn.,	27
Toledo Grain and Milling Co., Toledo, O.,	46, 59, 62
Toledo Mills, Toledo, O.,	17
Trenton Milling Co., Morrisville, Pa.,	27
Triplex Food Co., New Brunswick, N. J.,	74
Truesdale & Spear, Minneapolis, Minn.,	24, 27

W.

Walker, R. L., Duncansville, Pa.,	45, 59, 61
Walter, C. W., Walters, Pa.,	46
Warner Bros., Grant Station, N. Y.,	46
Warren Mills Co., Warren, Pa.,	27, 46
Warwick & Justice, Massillon, O.,	23
Washburn, Crosby & Co., Minneapolis, Minn.,	23
Weston, J. W., New York,	74, 23, 46
Weston Mill Co., Scranton, Pa.,	27
White Food Co., Taunton, Mass.,	74
Wilbur Seed Meal Co., Milwaukee, Wis.,	74
Wilt, G. P., Duncansville, Pa.,	45
Woodworth, E. S., & Co., Minneapolis, Minn.,	27

RETAIL DEALERS.

B.

Bare Milling Co., Roaring Springs,	24, 27, 45
Beckert, C., Pittsburg,	17, 24, 45
Beebe, D. H., Corry,	17, 46
Betts, B. A.,	24
Biddle, T. M., Altoona,	61
Bliss & Merrick, Corry,	17, 24, 27
Bock, Peter, Pittsburg,	17, 23, 27
Bostert, Gustav, Johnstown,	24, 27
Brant, Levi, Harrisburg,	17, 45
Branthoover Bros., Pittsburg,	27
Briggs, M., Woodbury,	24, 50
Brown & Co., Pittsburg,	27
Burkholder, Jos., Hummelstown,	26, 27
Byrne & Steele, Pittsburg,	17, 24, 27

C.

	Page.
Clapper Bros., Martinsburg,	27, 45
Clark, M. H., Uniontown,	24, 46
Cleland, W. H., Pittsburg,	17, 45
Cohn, B., Altoona,	61
Coleman, M. E., Pittsburg,	24, 46
Coyle & Diehl, Chambersburg,	24, 40
Craft, J. W., Ambler,	17, 41
Crouch Bros., Erie,	50, 54
Curry, J. B., Swatara Station,	50, 59, 61

D.

Deckard, J. B., Middletown,	31, 41
Densmore Bros., Erie,	24, 59
Dietrich, M. C., Kempton,	17, 24, 27, 50
Duffield, F. H., Langhorne,	62
Dyer, C. F., Millersburg,	17

E.

Eclipse Milling Co., Brownsville,	24, 46
---	--------

F.

Fisher, Wm., Allegheny,	24, 27
Friel, Chas., Pittsburg,	17, 23, 27

G.

Grardin, D. H., Jamestown, N. Y.,	59
Gring, H. H., Mohnsville,	45

H.

Hartz, David, Morgantown,	24, 27, 45
Heath, F. L., Corry,	17, 24, 59
Heebner, W. K., West Point,	17, 18, 24
Hockensmith, J. L.,	33, 61
Hoof, C. L., Altoona,	27

K.

Kartlick, L. W., Pittsburg,	59
Kellner, C., Allegheny,	17, 27, 45
King Bros., Uniontown,	17
Kirby, M. A.,	37, 50
Kissinger, A. N., & Son, Reading,	24, 27, 45

L.

Lechrone, W. W., Duncansville,	45, 48
Lingafelt, C. E., Hollidaysburg,	35, 48

M.

McCague, R. S., Pittsburg,	
McClelland & Siple, Pittsburg,	17, 23, 27, 45
McDermott, Wertz & Co., Johnstown,	27, 35
Manr & Allshouse, Easton,	62
Mentzer, F. & I., Frankstown,	24, 45
Mock, G. W., Rodman's Mills,	62
Moore, G. L., Brownsville,	17
Mulhollen, H.,	46

P.

Penn Traffic Co., Ltd., Johnstown,	17, 23
Pennock, C. W., Reading,	59
Pike, A. M., Halifax,	23, 32
Post, P. W., Altoona,	61

R.

Read, L. A., Chambersburg,	24, 40
Reeder, Jas.,	62
Reside, J., Chambersburg,	27
Romberger, Cyrus, Lykens,	23, 27, 59

S.

Sandt, J. P., Easton,	17
Schmehl, J. H., Scarlett's Mills,	48
Sears, C. H., Clark's Summit,	17, 33
Simpson Bros., Norristown,	18, 62
Sims Co., Erie,	37
Slight, L. T.,	23, 27
Snyder Bros., Dalton,	17, 23, 27, 58, 62, 66
Somes, A. S., Halifax,	17, 23

T.

Thomas, John, & Co., Johnstown,	27, 62
Trenton Milling Co., Morrisville,	24, 27

V.

Vance, S. B., Middletown,	23, 31
---------------------------------	--------

W.

Waggoner, L. L., Brownsville,	27
Walker, R. L., Duncansville,	45
Walter, C. W., Walters,	23, 27, 48
Warner Bros., Grant, N. Y.,	17, 46
Warren Mills Co., Warren,	18, 27, 46
Weston Mill Co., Scranton,	17, 23, 46, 61
Whitmyer, D., Allegheny,	27
Widman & Sheeler, Johnstown,	17, 27
Wilt, G. O., Duncansville,	23, 32, 40

GENERAL INDEX.

	Page.
A.	
Albuminoids, definition of,	7
American Cattle Feeding Salts,	69
American Poultry Food,	67
American Spiced Food,	70
American Triumph Horse and Cattle Food,	70
American Triumph Poultry Food,	70
Anglo-American Food for Stock,	70
Anglo-American Poultry Food,	70
Animal Regulator,	73
Anise Seed, in condimental foods,	77
Atlantic Gluten Meal, composition of,	49
B.	
Banner Poultry Food,	70
Banner Stock Food,	70
Barley and its by-products,	35
Barwell's Horse and Cattle Food,	70
Baum's Poultry Food,	70
Baum's Stock Food,	71
Benjamin's Food for Horses and Cattle,	71
Blatchford's Calf Meal,	68
Boiled beef and bone for poultry,	66
Brewer's grains, composition of,	37
Browne, C. A., Jr.,	37
Buckwheat products,	57
Buckeye wheat feed,	33
Buffalo gluten feed,	51
C.	
Carbohydrates,	92
Carob bean,	68
Cattle, nutritive ratio required in food for,	10
Cereal Feed (Amer. Cereal Co.),	56
Cerealine feeds,	56
Champion Horse and Cattle Food,	71
Charcoal in condimental foods,	75
Chemical constituents of foods,	7
Chicago feeds, sugar and starch in,	46

	Page.
Classification of concentrated feeding stuffs,	12
Climax Stock Food,	71
Clover meal,	67
Clover, red, in green condition,	9
Coefficient of digestibility defined,	8
Colonial Poultry Food,	71
Colonial Stock Food,	71
Coloring matters, analytical relations,	12
Composition of feeding stuffs,	84
Concentrated feeding-stuffs,	7
causes of demand for,	11
increased supply for,	11
relative value in supplying protein,	12
Condimental foods,	67
composition of,	68
cost of ingredients,	76
feeding value of,	68
medicinal value of,	77
peculiarities of analyses,	75
samples analyzed,	67
Connecticut, cattle-food law of,	99
Control of commerce in feeding-stuffs,	82
Corn,	42
bran,	52
chop,	45
cob,	45
cracked,	45
dent,	42
flint,	42
germ,	52
germ oil, manufacture of,	52
cake,	52
meal,	52
gluten products, process of manufacture,	49
hull,	41
kernel,	43
meal, composition of,	46
shelled, samples analyzed,	44
silage,	9
soiling,	9
stover,	9
Corn and oat feeds,	58
Corn and oat-hull feed,	60
Corn, oats and barley feeds,	63
Corn, Oats and Barley Feed (Amer. Cereal Co.),	65
Corn, oats and rye feeds,	63
Corn, oats and wheat feeds, composition of,	63
Corn-and-cob chop,	47
Corn-and-cob meal and oat feeds,	63
Corn-and-cob meal and rye feeds,	63
Cotton-seed meal,	13

	Page.
Cream gluten,	12
Crescent Oat Feed,	41
Cows, milk, nutritive ratio required in food of,	10

D.

Digestion, effect of condiments upon,	77
influenced by mechanical condition of food, process of,	77
Drugs used in condimental foods,	77

E.

Eggine,	71
English Horse Food,	72
Epsom salts in condimental foods,	76
Ether-extract, definition of,	7
Eureka Egg Food,	71

F.

Farm food products,	9
composition of,	9
nutritive values of,	9
Fat, definition of,	7
heat of, combustion of,	8
nutritive values of,	9
Feeding-stuffs,	7
concentrated, classification of,	12
percentage of protein in,	79
composition in different States,	81
expenditure for protein in various States,	81
regulation of commerce in,	80
weight of various,	83
composition of feeding stuffs,	84
Fennel seed in condimental foods,	77
Fenugreek in condimental foods,	77
Fiber, definition of,	7
Flax seed, composition of,	16
Flower City Horse and Cattle Food,	72
Forage crops,	9
Friends' Consolidated Dairy Food,	42

G.

Germ-oil cake,	52
Germ-oil meal, composition of,	52
Ginger in condimental foods,	77
Glauber's salts in condimental foods,	77
Glucose, by -products of manufacture,	51
Gluten feed,	49
Gluten meal,	49
Grains, composition of,	12
nature of protein in,	12
nutritive ratio of,	9
Grass, pasture,	9

H.

	Page.
Hays,	3
Heats of combustion of food constituents,	8
High milling process,	20
H. O. Dairy Feed,	66
H. O. Horse Feed,	66
Hominy chop,	54
Hominy feed,	54
Horse, nutritive ratio required in food of,	10
Hungarian grass,	9
green,	9
hay, composition of,	9

I.

Ideal Egg Food,	72
International Poultry Food,	72
International Stock Food,	72

J.

Jenkins, E. H.,	19
Jenter, C. G.,	12
Jersey Tonic and Condition Powders,	72
Jordan, W. H.,	12

K.

Knight's Poultry Food,	72
Knight's English Vegetable Food,	72

L.

Laxatives in condimental foods,	78
Leguminous crops, food value of,	9
Lightning Horse, Cattle and Poultry Powders,	72
Linseed meal,	16

M.

Magic Poultry Food and Egg Producer,	73
Magic Stock Food,	73
Maine, cattle food law of,	101
Maize (see corn),	42
Malt sprouts,	37
Mangel-wurzel,	47
Massachusetts, cattle food law of,	103
Matthews Compound Food,	73
McDowell, M. S.,	11
Medicated Meal,	73
Mixed feed,	58
Mixed wheat feeds, relative composition in different States,	81

N.

	Page.
New Jersey, cattle-food law of,	104
New York, cattle-food law of,	107
Nitrogenous matter, analytical relations of,	12
Non-albuminoids, definition of,	7
Nutriotine,	73
Nutritive ration, definition of,	9
Nutritive ratios of farm foods,	9
required for farm animals,	10
Nutritive values of the several food constituents,	79

O.

Oat feeds,	40
Oat hulls,	41
Oat kernel, composition of,	41
Oat straw,	9
Oats and oat products,	38
ground,	40
soiling,	9
Orange Electric Food,	73
Oxen, nutritive ratio required in food of,	10
Oyster shells,	75

P.

Pasture, grass, nutritive ratio of,	9
Pennsylvania, cattle food law of,	111
Pillsbury's Best Wheat Flour,	34
Pingree, M. H.,	11
Potatoes,	9
nutritive ratio of,	9
composition of,	9
Poultry foods,	66
Poultry meal,	67
Prolific Poultry Food,	74
Protein,	7
definition of,	7
heat of combustion of,	9
nutritive uses of,	9
deficiency in domestic food supply,	10
relative value of feeds in supplying,	78
Purgatives in condimental foods,	77

Q.

Quaker Dairy Food,	65
composition of,	65
expenditure for protein in,	65
relative composition in different States,	65
samples analyzed,	65

R.

Red Dog Flour,	32
composition of,	32

	Page.
definition of,	22
expenditure for protein in,	32
Rhode Island, cattle food law of,	113
Rice bran, composition of,	67
Rice feed for poultry,	67
Rice hulls, composition of,	67
polish, composition of,	67
Richardson, C.,	39
Roller milling process,	20
Root crops, composition of,	9
nutritive ratio of,	9
Royal Horse and Cattle Spice,	73
Royal Oat Feed,	41
composition of,	41
microscopic examination of,	42
Royal Poultry Spice,	73
Royal Stock Food,	74
Ruta-baga, composition of,	9
nutritive ratio of,	9
Rye products,	34
composition of,	34
nutritive ratio of,	9
products, samples analyzed,	35
value as a horse food,	35
Rye bran, weight of,	35
Rye chop, composition of,	35
expenditure for protein in,	35
Rye middlings, composition of,	35
Rye-straw, composition of,	9
nutritive ratio of,	9
Rye and corn feeds,	63
composition of,	63
expenditure for protein in,	63
samples analyzed,	63
Rye and oat feeds,	63
composition of,	63
expenditure for protein in,	63
samples analyzed,	63

S.

Salt in condimental foods,	76
Sheep, nutritive ratio required in food of,	10
Sheridan's Condition Powders,	74
Shipstuff,	31
composition of,	31
definition of,	22
mill yield of,	21
Shorts, wheat,	31
composition of,	31
mill yield of,	21
Silage, corn, composition of,	9
nutritive ratio of,	9

	Page.
Simpson Bros. Condimental Stock Food,	68
Soiling crops, composition of,	9
nutritive ratio of,	9
Starch, analytical relations of,	12
proportions in principal feeding stuffs,	12
Stomachics in condimental foods,	77
Stone-milling process,	20
Stover, composition of,	9
nutritive ratio of,	9
Straws, composition of,	9
nutritive ratio of,	9
Sucrene Dairy Feed,	66
composition of,	66
expenditure for protein in,	66
Sugar corn feed,	53
composition of,	54
expenditure for protein in,	54
Sugar feed,	53
composition,	53
expenditure for protein in,	53
Sugars, analytical relations of,	12
proportion in principal feeding-stuffs,	12
Sulfur in condimental foods,	76
Swine, nutritive ratio required in food of,	10

T.

Timothy, green, composition of,	9
nutritive ratio of,	9
hay, composition of,	9
nutritive ratio of,	9
Tonics in condimental foods,	78
Triplex Poultry Food,	74
Triplex Stock food,	74
Turnips, composition of,	9
nutritive ratio of,	9

V.

Venetian red in condimental foods,	76
Vermont,	116
Victor Corn and Oat Feed,	59
composition of,	59
digestibility of nitrogen,	12
free extract in,	12
expenditure for protein in,	60
relative composition in different States,	81
sugar and starch in,	12
weight of,	83
Voorhees, E. B.,	43

W.

Weight of feeding-stuffs,	83
Wheat products,	19
composition of,	19

	Page.
structure of grain,	20
milling processes,	20
milling products, description and composition,	22
yield of several products,	22
nutritive ratio,	22
scorched, composition of,	23
sugar and starch in,	12
weight,	83
Wheat bran,	23
definition of,	22
adulterations of,	22
composition of,	24
digestibility of nitrogen-free extract in,	12
expenditure for protein in,	26
impurities of,	25
milling yield of,	21
relative composition in different States,	81
samples analyzed,	23
sugar and starch in,	12
weight of,	83
winter vs. spring,	24
Wheat dust, composition of,	22
mill yield of,	21
Wheat foods,	32
composition of,	33
definition of,	22
expenditure for protein in,	33
impurities of,	33
relative composition in different States,	81
samples analyzed,	33
weight of,	83
Wheat flour,	34
composition of,	34
milling yield of,	21
Wheat germ, composition of,	22
Wheat middlings,	27
composition of,	28
definition of,	22
digestibility of nitrogen-free extract,	12
expenditure for protein in,	30
milling yield of,	21
relative composition in different States,	81
samples analyzed,	27
sugar and starch in,	12
weight of,	83
Wheat screenings, milling yield of,	21
Wheat shorts,	31
composition of,	31
definition of,	22
expenditure for protein in,	31
milling yield of,	21
samples analyzed,	31
Wheat straw, composition of,	9

	Page.
nutritive ratio of,	9
Wheat tailings, mill yield of,	21
Wheat and corn feeds,	65
composition of,	65
expenditure for protein in,	65
Wheat and oats feed,	65
composition of,	65
expenditure for protein in,	65
Winton, A. L.,	66

